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SECTION X

(4th EDITION)

GAS ANALYSIS

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IN compiling this New Edition of our Standard Catalogue in Sectional Form, our aim has been to make it as convenient as possible for our clients to find any article they want, in the minimum space of time. Below will be found an outline of the Contents of each Section:—

SECTION I.—Typical examples of Benches, Fume Cupboards, Taps and Sinks, and is meant as a guide to clients when designing their laboratories.

SECTION II.—Apparatus required for the permanent equipment of a laboratory such as Balances, Furnaces, Ovens, Pumps and Stills alphabetically arranged.

SECTION III.—Ordinary apparatus required for laboratory use, such as Glassware, Porcelain Ware, Filter Paper and Graduated Ware, etc. These are also arranged alphabetically.

SECTIONS IV and V.—Thermometers and Pyrometers and heat-recording apparatus for all purposes.

SECTION VI.—Special apparatus scientifically grouped and arranged for all branches of Physico-Chemical Work.

SECTION VII.—Refractometers, Spectroscopes and Polariscopes.

SECTION VIII to SECTION XIV.—Specialised apparatus of all descriptions such as is required for Scientific and Industrial Research Laboratories as detailed in the Section Summary.

SECTION XV.—Apparatus for all the branches of Meteorology, etc.

SECTION XX.—Models for Anatomical work; a fuller and complete catalogue is sent on application.

SECTION XXI.—Apparatus for Botany and Entomology.

SECTION XXII.—A full range of British and Foreign Microscopes, Epidiascopes, Episcopes, and Cameras for scientific purposes.

SECTION XXIII to SECTION XXVI.—Special apparatus for Bacteriology, Histology, Microscopy, Pathology and Biochemistry such as Microscope Slides, Cover Glasses, Microtomes, Incubators, Autoclaves, Embedding and Wassermann Baths, etc.

SECTION XXVII to SECTION XXVIII.—Special apparatus for Physiology, Pharmacology and Psychology.

Lists of Technical books and Index complete the whole range of Apparatus Standard Catalogue Vol. I, II, III. Vol. IV is still



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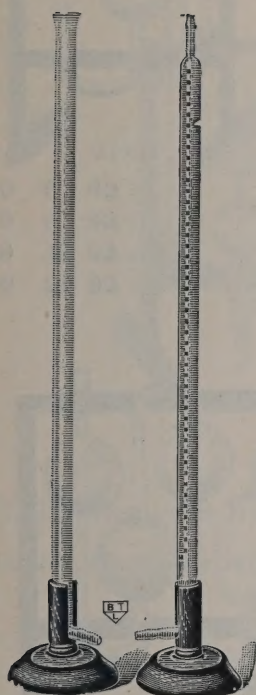
BAIRD & TATLOCK (LONDON) LIMITED

SECTION
X
GA

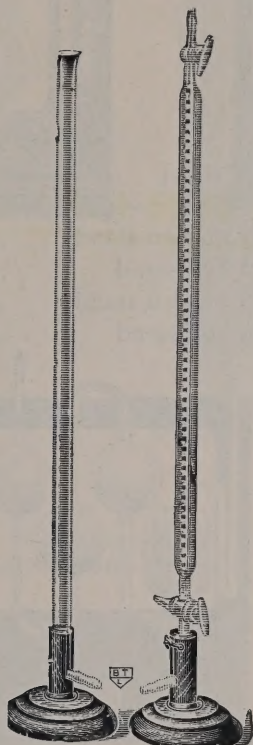
SECTION X.

Gas Analysis.

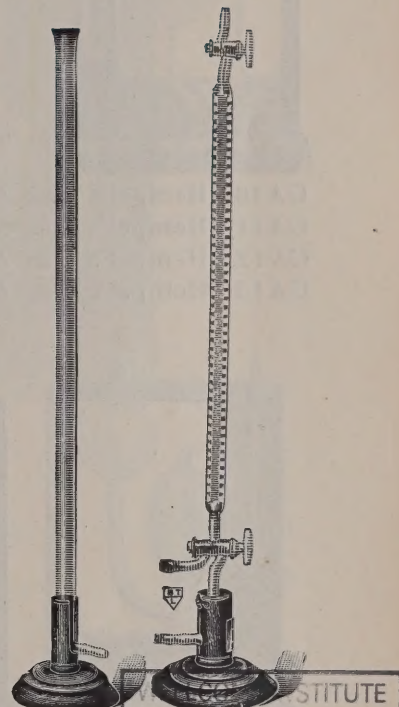
GAS ANALYSIS APPARATUS.



GA1



GA2



GA4

Hempel's Gas Burette. The following advantages are claimed for this apparatus :

1. It admits of the use of all sorts of solid or liquid reagents.
2. It allows of a complete exhaustion or utilisation of the reagents.
3. It greatly obviates the errors due to the mechanical absorption of gas by the absorbing agents, and finally, it can be used for the analysis of mixtures of N_2 , H_2 , and CH_4 , giving results which are sufficiently accurate for technical purposes.

The apparatus consists of :

- GA1 Hempel's Gas Burettes**, one plain and the other graduated, on wood soles, connected at the foot by an india-rubber tube. The graduated tube is drawn out at top for the attaching of an india-rubber tube.... Without india-rubber tube, per pair **£0 17 6**
- GA2 Hempel's Gas Burettes**, as above, but graduated tube is furnished with a stopcock at top and a three-way stopcock at bottom Without india-rubber tube, per pair **£1 5 0**
- GA4 Hempel's Gas Burettes**, as above, with oblique bored stopcock.
Without india-rubber tube, per pair **£1 10 0**

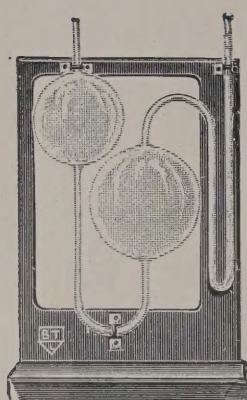
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NOTE

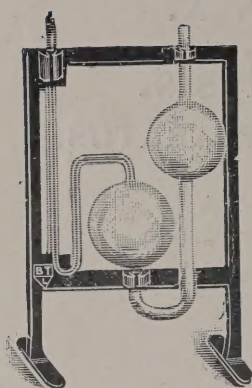
When indenting for our quality Apparatus, clients will greatly oblige by specifying the Catalogue Number and marking their indents:—

To be obtained from BAIRD & TATLOCK (LONDON), Ltd.

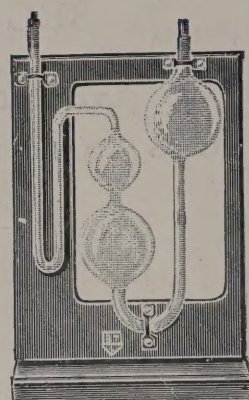




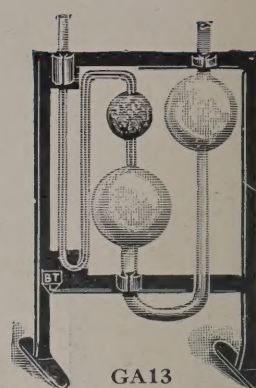
GA10



GA11

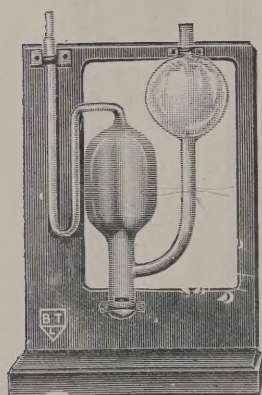


GA12

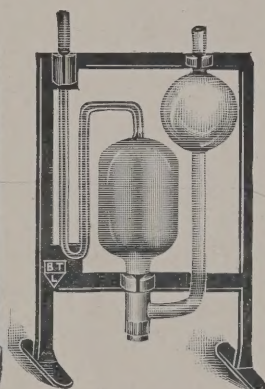


GA13

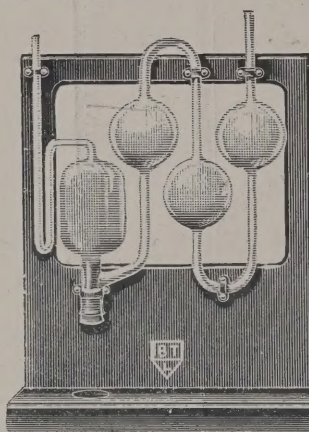
GA10	Hempel's Gas Absorption Bulbs, on wooden stand	....	....	....	....	b £0 9 0
GA11	Hempel's Gas Absorption Bulbs, on iron stand	....	....	....	....	b £0 9 0
GA12	Hempel's Gas Absorption Bulbs, on wooden stand	....	....	....	....	b £0 11 0
GA13	Hempel's Gas Absorption Bulbs, on iron stand	....	....	....	....	b £0 12 0



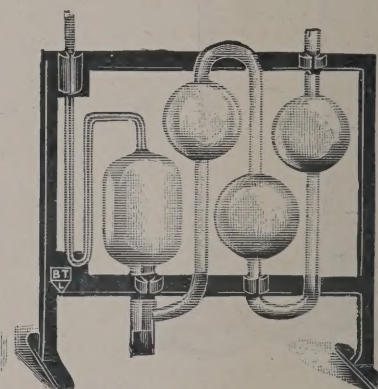
GA14



GA15

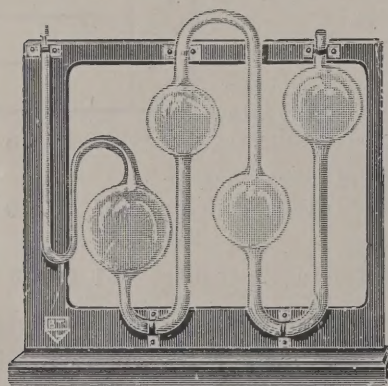


GA16

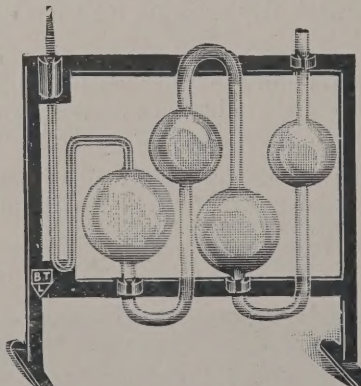


GA17

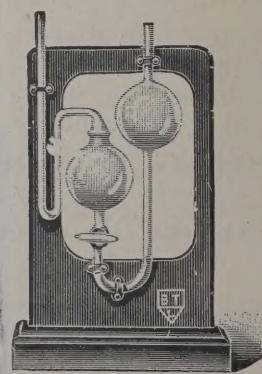
GA14	Hempel's Gas Absorption Bulbs, for solid absorbing reagents, with brown bulb, on wooden stand	b £0 12 6
GA15	Hempel's Gas Absorption Bulbs, for solid absorbing reagents, with brown bulb, on iron stand	b £0 12 6
GA16	Hempel's Gas Absorption Bulbs, for solid absorbing reagents, on wooden stand	 b £0 15 6
GA17	Hempel's Gas Absorption Bulbs, for solid absorbing reagents, on iron stand	 b £0 15 6



GA18

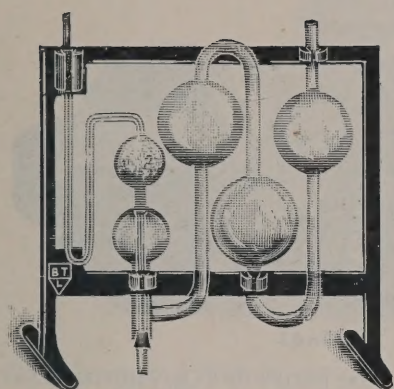


GA19

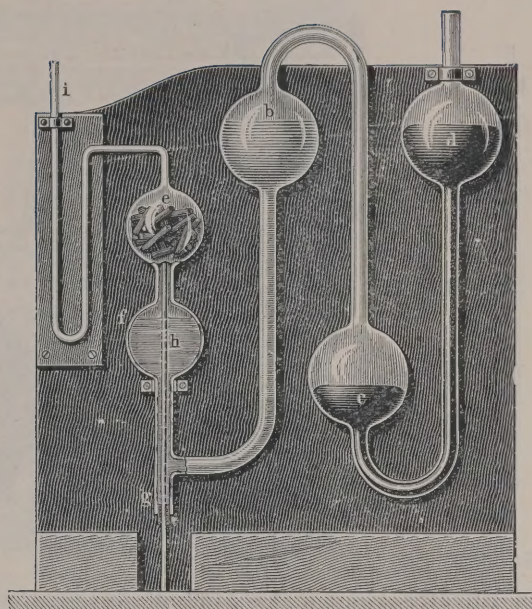


GA20

GA18	Hempel's Gas Absorption Bulbs, on wooden stand	....	....	....	....	b £0 15 0
GA19	Hempel's Gas Absorption Bulbs, on iron stand	....	....	....	....	b £0 15 0
GA20	Hempel's Explosion Pipette, with platinum electrodes and stopcock	....	....	....	....	b £0 17 6

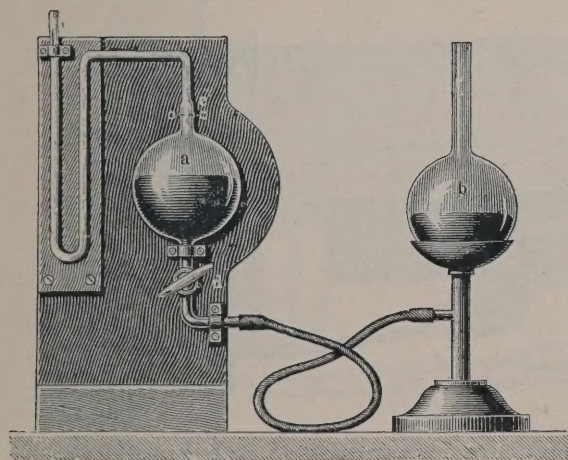


GA22

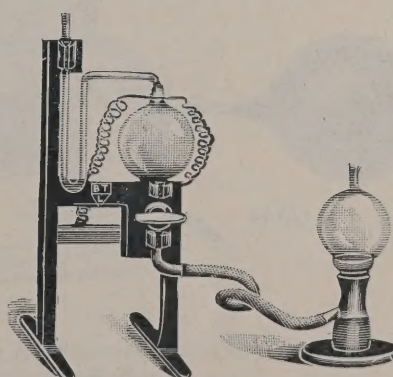


GA24

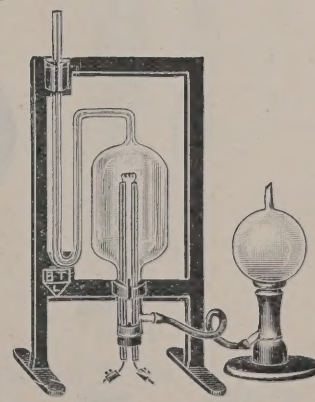
GA22	Hempel's Hydrogen Pipette, on iron stand	....	....	....	....	....	b £0 15 0
GA24	Hempel's Hydrogen Pipette, on wooden stand	....	....	....	....	....	b £1 0 0



GA26

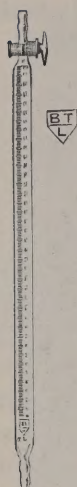


GA28



GA29

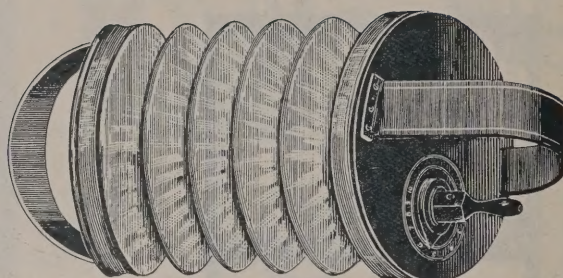
GA26	Hempel's Explosion Pipette, with platinum electrodes and stopcock, on wooden stand	....	....	....	....	b £1 5 0
GA28	Hempel's Explosion Pipette, as above, on iron stand	....	....	....	....	b £1 5 0
GA29	Hempel's Combustion Pipette, modified by Winkler-Dennis	....	....	....	....	b £1 10 6



GA30



GA32



GA42

- GA30 Gas Burette**, Honigmann's 100 ml. in $\frac{1}{8}$ ths, for determining the purity of CO_2 , etc.

A.	Without jar	....	....	....	....	....	c £0 15 0
B.	With jar	....	....	....	....	....	c £0 17 3

- GA32 Gas Burette**, devised by A. J. C. Cosbie, for quickly determining the amount of air in CO_2 . The percentage of air from 1% to 0.1% is read off directly on the scale. With directions for use

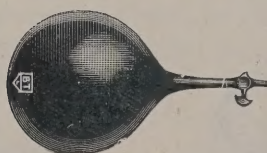
£0 14 6

- GA42 Fletcher's Collapsing Aspirator**, for sampling gases. Ebonite ends, india-rubber body, leather strap on each end, with ebonite nozzle and indicator. Capacity about $\frac{1}{10}$ cubic ft.

e £4 12 6

- GA43 Leather case for ditto extra £1 10 0

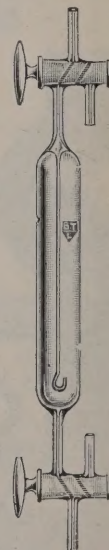
e £1 10 0



GA44



GA46

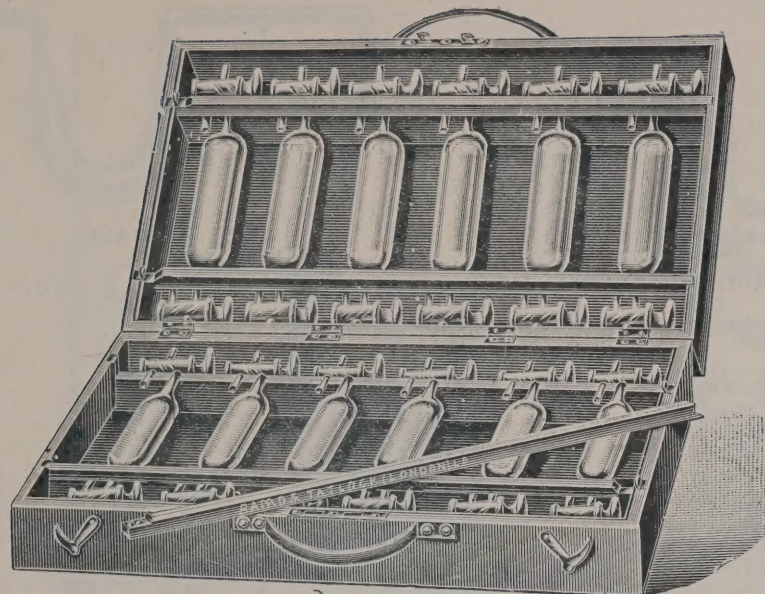


GA47

- | | | | | | |
|-------------|--|------|------|----------|---------------|
| GA44 | Gas Bags, india-rubber, 5 in. wide when flat, with vulcanite stopcock | | each | <i>d</i> | £0 5 0 |
|-------------|--|------|------|----------|---------------|

- | | | | | | | |
|------|---|------|------|------|----|----------|
| GA46 | Gas Sampling Tubes, with two stopcocks, $9 \times 1\frac{1}{8}$ in. | | | | .. | b £0 9 0 |
|------|---|------|------|------|----|----------|

- GA47 Gas Sampling Tube**, Huntley's. (See "Journal of the Society of Chemical Industry," 1910, page 312) £0 13 6

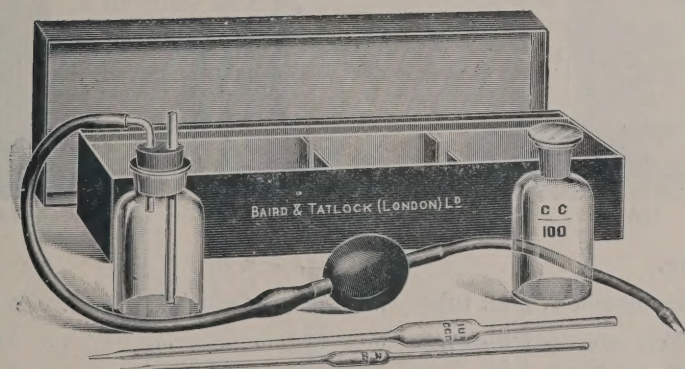


GA48

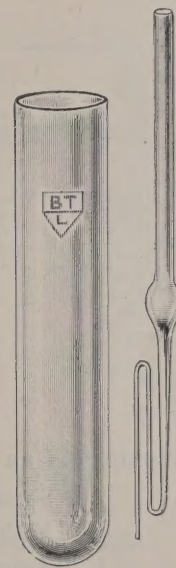
GA48 Gas Sampling Tubes, capacity 50 to 60 ml., with special stopcock at each end, set of twelve in polished mahogany case with lock and key d £11 10 0

GA50 Gas Sampling Tubes, as above each d £0 16 6

(See Fig. 127, p. 144, "Practical Physiology," by Drs. Pembrey, Hill, Edkins, MacLeod, and Beddard, 1905, 2nd edition.)



GA52



GA54

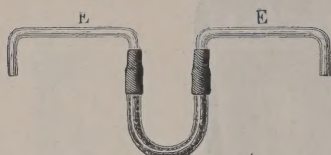
GA52 Lunge and Zeckendorf's Apparatus for determination of CO_2 in air, complete in box, with directions for use and tables, without solution d £1 2 6

GA54 The "Barwell" Carbon Dioxide Detector. Price with corked outer protection tube b £0 2 3

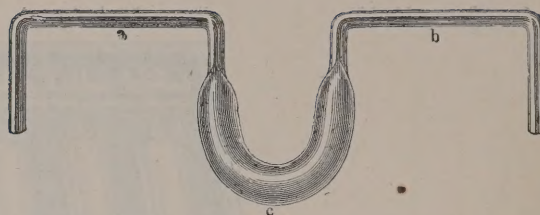
This apparatus satisfies a long-felt need for a simple but efficient means of detecting carbon dioxide. The old method of pouring the gas into lime water is inefficient and uncertain, and the cumbersome apparatus described in chemistry text-books needs to be fitted up for use each time it is required.

To use this apparatus Baryta water is drawn up into the bulb through the capillary until the bulb is about a third full. The apparatus is then lowered into the vessel in which the carbon dioxide is suspected of existing, and gentle suction is applied at the tube. A milkiness in the bulb of the apparatus indicates the presence of carbon dioxide.

GA56 Suction Bulb for above b £0 3 0

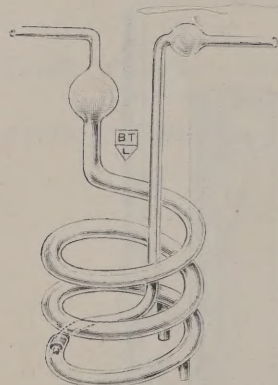


GA62

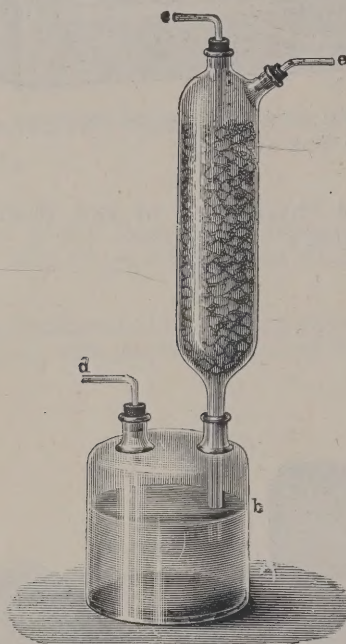


GA64

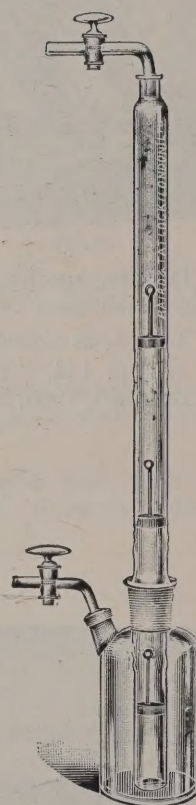
GA62	Palladium Tubes, filled with palladised asbestos	....	....	Price variable	d	£1	5	0
GA64	Palladium Tubes	....	....	..	d	£1	5	0



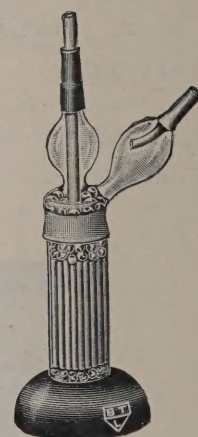
GA66



GA68



GA70



GA72

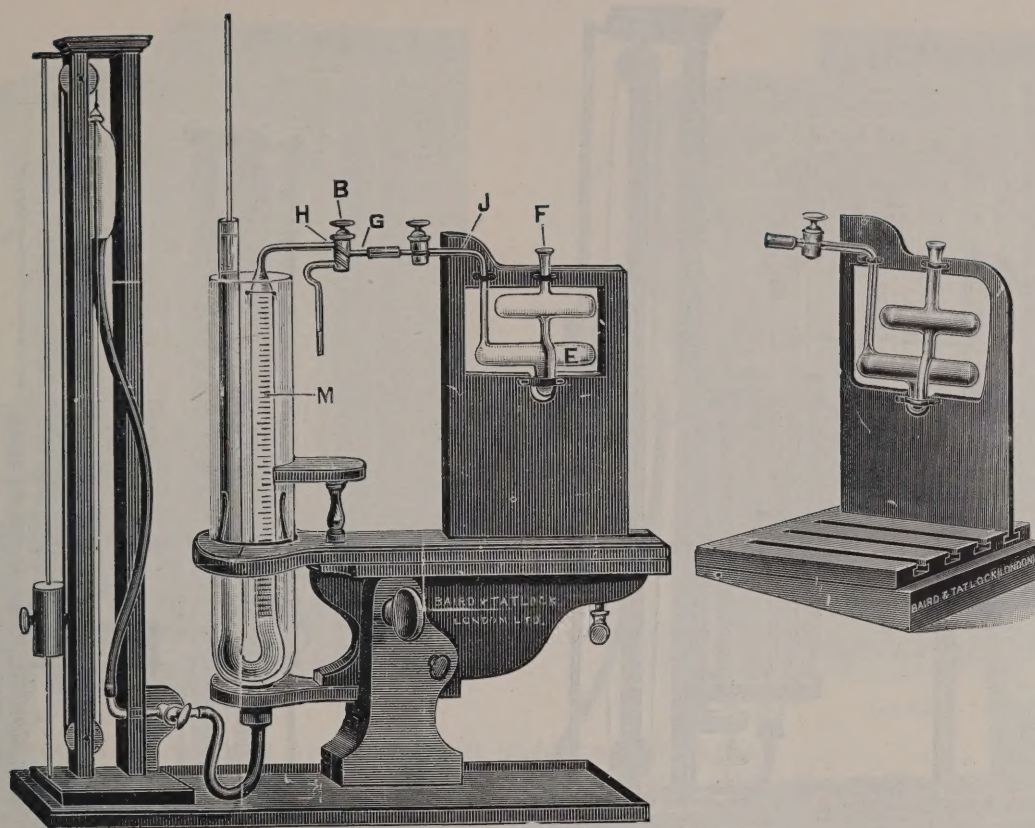
GA66 Winkler's Gas Absorption Tube.

A.	Small, spirals about 3 in. diameter, $\frac{3}{8}$ -in. tube	....	....	....	b	£0	4	0
B.	Medium, „ 4 in. „ $\frac{3}{8}$ -in. „	....	....	....	b	£0	6	6
C.	Large, „ 6 in. „ $\frac{1}{2}$ -in. „	....	....	....	b	£0	9	0

GA68 Winkler's Gas Absorption Apparatus

GA70	Reiset's Apparatus, for the determination of carbon dioxide in the atmosphere, with three perforated silver cones; diameter of tube 25 millimetres, height of tube 50 centimetres, capacity of bottle 350 millilitres				c	£3	0	0
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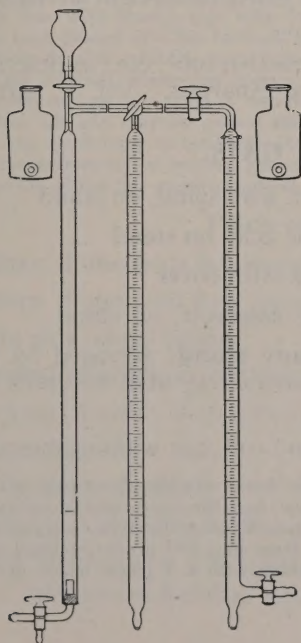
GA72	Absorption Apparatus, devised by S. W. Bunker, specially suitable for absorbing the constituents of sparingly soluble gases in small quantities of liquid. The gas is broken up into small bubbles, and these are passed in turn through layers of glass beads and columns of capillary tubes which are drenched with the absorbing fluid. The apparatus will work with from 10-15 ml. of liquid				b	£0	10	6
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GA73

GA73 Macfarlane and Caldwell's Gas Analysis Apparatus, complete on mahogany stand, with four mounted absorption pipettes and sloping stand for holding same d £17 17 0

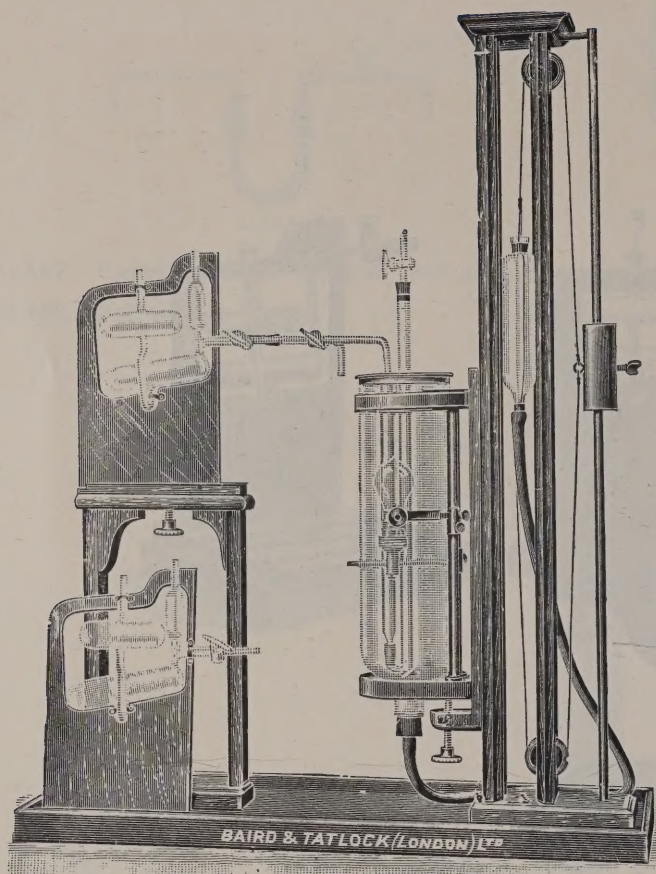
A modified form of apparatus for the analysis of gases. By Messrs. Walter Macfarlane, F.I.C., and Peter Caldwell. (See "Journal of the West of Scotland Iron and Steel Institute," No. 2, vol. i, 1892.)



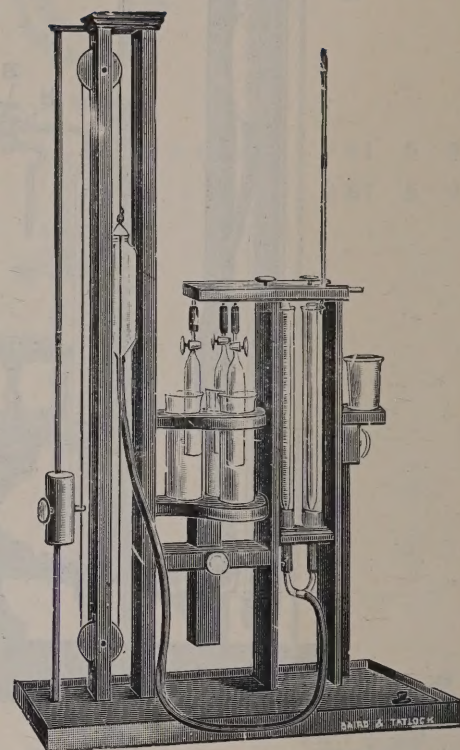
GA74 Elliott's Gas Analysis Apparatus, with explosion pipette (glass parts only) d £3 3 0

(See Mr. A. H. Elliott's article in the "Chemical News," 19th October 1883.)

GA74



GA76



GA88

GA76 Gas Analysis Apparatus, Macfarlane and Caldwell's, modified by Mr. Sodeau, original pattern, as used in the Research Department, Royal Arsenal, Woolwich. The apparatus is mounted on polished stand, and has lens sliding on upright for reading graduations on measuring tube; a $2\frac{1}{2}$ candle-power electric lamp is also fitted on upright at back of tube. Price, with three special absorption pipettes d £21 0 0

GA78 Gas Analysis Apparatus, as above, latest pattern, with correction tube, etc., as described in Lunge and Keane's "Technical Methods of Chemical Analysis," vol. i, part 1. Complete with three special pipettes d £22 5 0

Additional Pipettes for use with GA78.

GA80 Combustion Pipette, with three-way stopcock and platinum wire spiral, on stand d £1 10 0

GA82 Ethane Pipette, for absorption by means of fuming sulphuric acid, on stand d £1 0 0

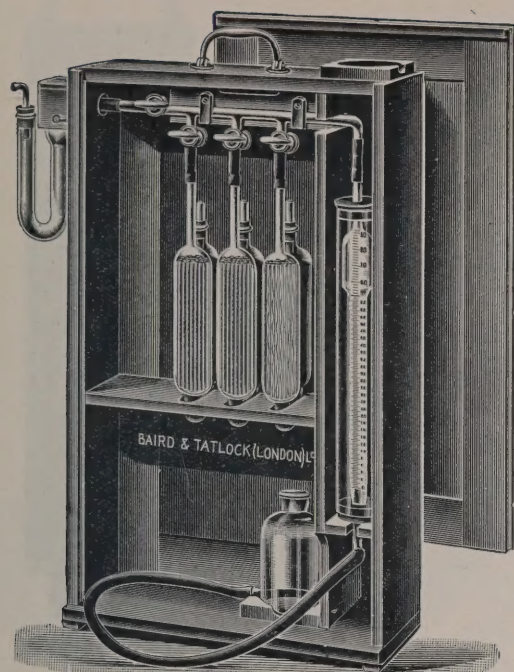
GA84 Phosphorus Pipette, with three-way stopcock, in metal box with cover d £1 10 0

GA86 Explosion Pipette, with three-way stopcock and mercury reservoir, on stand d £3 0 0

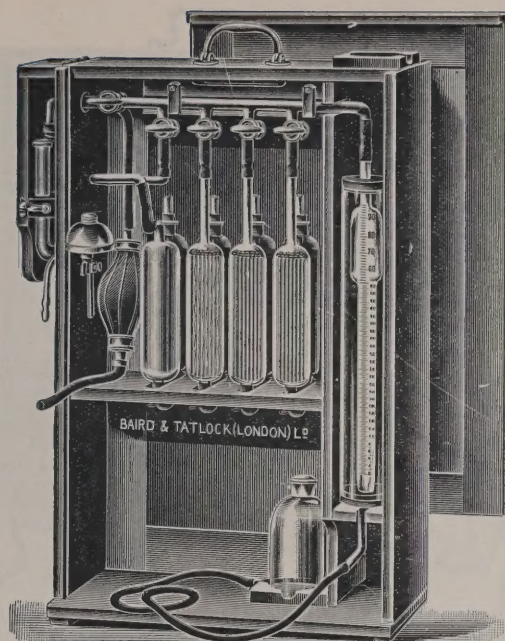
GA88 Stead's Gas Apparatus, mounted on polished mahogany stand, arranged by Mr. J. E. Stead, F.I.C., Middlesborough. Price, with three laboratory tubes and jars, but without battery, coil, and mercury d £8 8 0

GA89 Stead's Gas Apparatus, as above, complete with battery and coil, but without mercury d £10 10 0

Consists of a measuring tube divided into 270 millimetres and platinum electrodes fused into the upper part of tube. The bottom is drawn out to a bore of about $\frac{1}{4}$ in. for attaching an india-rubber tube, and the upper end is contracted and joined at a right angle to the laboratory tubes by a three-way capillary tube, a stopcock being placed at each junction. The whole tube is enclosed in an outer glass cylinder. The auxiliary tube is of the same size, and is also enclosed in an outer cylinder. These tubes are connected at bottom by means of india-rubber tubing with a Y-piece, which in turn communicates with the mercury reservoir.



GA90



GA92

GA90 Orsat's Gas Analysis Apparatus, with three absorption bulbs c £5 17 6

Consisting of a measuring tube holding 100 ml. graduated to 40 ml. in fifths, which is connected by means of a capillary tube with branch taps with three absorption bulbs. The gas enters through tube on the left and is measured. It is then passed into the furthest absorption bulb, which contains a solution of caustic potash or soda. This absorbs the carbon dioxide, and the gas is now measured and passed into the second absorption bulb, which contains an alkaline pyrogallol solution, where the oxygen is absorbed. After the gas is again measured it is run into the third absorption vessel, when carbon monoxide is removed by an acid cuprous chloride solution. After the final measurement the residual gas can be discharged into the air through the spare branch of the horizontal tube and a fresh portion of the flue gases admitted.

GA92 Gas Analysis Apparatus, Orsat-Lunge, for testing flue gases, with palladium asbestos tube, complete in portable box c £7 5 0

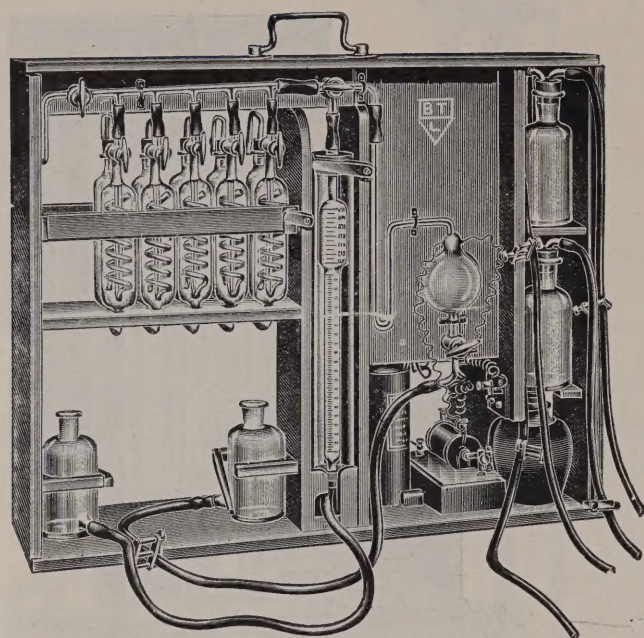
This apparatus consists of a measuring tube holding 100 ml. graduated to 40 ml. in fifths, which is connected by means of a capillary tube with branch taps with four absorption bulbs. The gas enters through tube on the left and is measured. It is then passed into the furthest absorption bulb, which contains a solution of caustic potash or soda. This absorbs the carbon dioxide, and the gas is now measured and passed into the second absorption bulb, which contains an alkaline pyrogallol solution, where the oxygen is absorbed. After the gas is again measured it is run into the third absorption vessel, when carbon monoxide is removed by an acid cuprous chloride solution. Finally, if the presence of hydrogen is suspected, the gas may be passed through the bent tube containing palladium asbestos, which should be slightly warmed by the spirit lamp to facilitate absorption of hydrogen.

After the final measurement the residual gas can be discharged into the air through the spare branch of the horizontal tube and a fresh portion of the flue gases admitted.

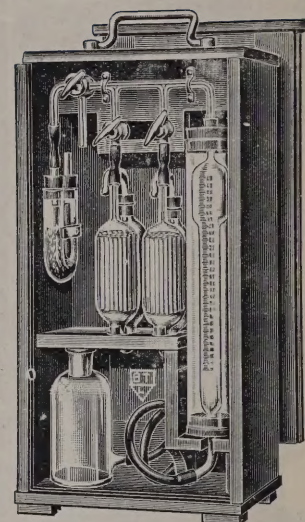
Price of spare parts for Nos. GA90-GA92.

GA94	Capillary Tube with five stopcocks for No. GA92	.....	c £1 14 0
GA95	Capillary Tube with four stopcocks for No. GA90	.....	c £1 6 6
GA96	Burette with water jacket	.....	c £0 16 0
GA97	Absorbing Vessel filled with glass tubes	.....	c £0 7 6
GA98	Absorbing Vessel filled with glass tubes and copper wire	 each	c £0 9 6
GA99	Pressure Bottle	.....	c £0 2 3
GA100	India-rubber Bellows	.....	c £0 3 0
GA101	Palladium Asbestos Tube	.....	c £0 7 0
GA102	Rubber Bags for O ₂ absorption bulbs	 each	c £0 0 4

Reagents for Gas Analysis Apparatus, see Chemical Section XXXI.



GA104



GA122

GA104 Portable Gas Analysis Apparatus, for the analysis of producer gases. This apparatus is a modified form of the ordinary Orsat's apparatus, the burette and absorption vessels being only half the usual size. The burette is 50 ml. capacity, but is graduated to read directly as 100 ml., and the bulbs are of a novel and very efficient form. An explosion pipette is provided with the necessary coil, dry cell and switch; also two aspirating bottles fitted with I.R. bungs and tubes serve for collecting and introducing the gas. The case is fitted with sliding doors back and front, and carrying handle, and measures $24 \times 20\frac{1}{2} \times 7\frac{1}{4}$ in. overall.

Price complete as illustrated, but without bottle of mercury d £12 12 0

Spare Parts.

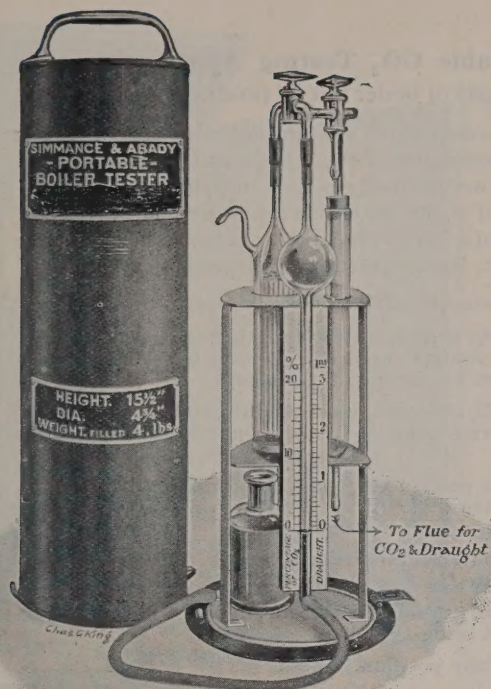
GA106 Burette	 d £0 15 0	GA116 Reservoirs	 d £0 2 3
GA108 Water Jacket	 d £0 4 6	GA118 Aspirating Bottles, without fittings	d £0 0 9
GA110 Absorption Bulb	 d £1 5 0	GA120 Tube with five branches and stopcock	d £0 18 0
GA112 Explosion Bulb	 d £0 16 0		

GA122 Orsat's Gas Analysis Apparatus, small portable type, with two absorption bulbs.

The burette has a capacity of 50 ml., but is graduated to read as 100 ml., thus enabling direct percentage readings to be taken; size of case, $15 \times 7\frac{1}{2} \times 5$ in.; weight without reagents approximately $5\frac{3}{4}$ lbs. d £4 10 0

GA123 Orsat's Gas Analysis Apparatus, portable type, as above, but with three absorption

bulbs; size of case, $15 \times 10 \times 5$ in.; weight without reagents approximately $6\frac{1}{2}$ lbs. d £5 5 0



GA130



GA132

GA130 Simmance and Abady's Portable Boiler Tester, for ascertaining the percentage of CO_2 and the draught in flues. Complete in portable metal case e £3 11 6

DESCRIPTION.

The instrument consists of a special burette and a concentric absorption tube or pipette mounted on a circular metal stand and furnished with the necessary stopcock and bottle containing water. The burette is made in such a form as to be adapted for use as a draught gauge, and in order that the readings shall be plain, it is furnished with a double scale graduated on one side with percentage of CO_2 and on the other side with fractions of inches of draught.

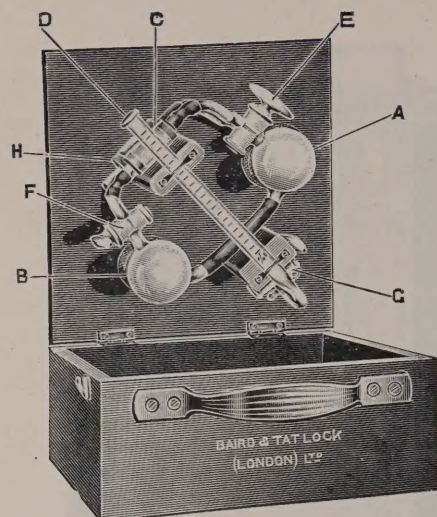
On being connected to the flue with the water levelled to the zero on the scale by the bottle, the draught is shown on the scale when the tap is opened. Without disconnecting, the bottle is used to draw in a sample of gas, which is then analysed, and the percentage of CO_2 is read off the other side of the scale. The whole test for both draught and CO_2 can be carried out in a few minutes by an inexperienced person.

The apparatus weighs only 4 lbs. and is covered by a stout metal cylindrical case, so that there is nothing to warp or strain, and very little liability to breakage. It can be carried from boiler to boiler and a test made in any part of the flue. The size of the case is: height, $15\frac{1}{2}$ in.; diameter, $4\frac{1}{4}$ in.

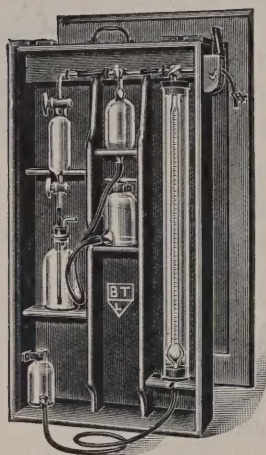
- GA132 Wright's "Orsat" Analysis Apparatus**, with two absorption bulbs for CO_2 and O_2 , complete in case e £4 16 3
- GA134 Wright's "Orsat" Analysis Apparatus**, with three absorption bulbs for CO_2 , O_2 , and CO , complete in case e £7 3 0
- GA136 Wright's "Orsat" Analysis Apparatus**, with four absorption bulbs for CO_2 , O_2 , and two for CO (to ensure more complete absorption of CO), complete in case e £8 3 0
- GA138 Wright's "Orsat" Analysis Apparatus**, with four absorption bulbs for CO_2 , O_2 , CO , and H_2 , complete in case e £9 1 6

The form of "Orsat" apparatus illustrated above is an improved and simplified one for determining rapidly the percentage of carbon dioxide (CO_2), carbon monoxide (CO), oxygen (O_2), and hydrogen (H_2) in waste, producer and other gases. Its advantages over the ordinary forms may be summarised as follows:

1. **Portability.** The Wright "Orsat" is half the weight and one quarter of the bulk of the ordinary type.
2. **Durability.** The absorption bulbs are compact, strong and not liable to break, and a breakage can be replaced at a small cost.
3. **Compactness.** The concentric absorption bulbs or pipettes and their arrangement makes the apparatus very compact and easy to handle.
4. **Accuracy.** The apparatus, owing to its compactness, can be bodily shaken when the gas is in contact with the reagents. A complete absorption of the constituents can thus be obtained.
5. **Cheapness.** The first cost of the apparatus and its durability enable it to compare very favourably with the ordinary patterns.



GA139



GA140

GA139 Daynes' Portable CO₂ Testing Apparatus, for the analysis of boiler flue or producer gases.

This instrument has been designed to meet the need for a simple portable instrument for determination of CO₂ in boiler and producer flues, etc. It is based on the well-known principles embodied in the familiar Orsat apparatus, and at the same time convenient for use under the trying conditions of a boiler plant, where measurements often have to be made in hot, badly lighted and cramped positions.

The following are the main advantages of the apparatus :

- (1) The gas is collected by drawing directly through the instrument and the right volume automatically measured off at atmospheric pressure by turning off the taps.
- (2) The percentage of CO₂ absorbed can be read throughout the analysis, thus ensuring complete absorption without loss of time.
- (3) Only one reading is necessary, namely the final level of water in the graduated tube. There is no accurate adjustment of liquid levels during the analysis.
- (4) The absorbent (sofnolite) is granular and changes from green to red when exhausted.
- (5) The apparatus is small (its dimensions being $6\frac{1}{2} \times 6\frac{1}{2} \times 3\frac{1}{2}$ in.) and light (its weight being $1\frac{3}{4}$ lb.).
- (6) It can be carried in any position.
- (7) Complete analysis takes only about one minute.

Price with instructions for use e £4 4 0

GA140 Dr. Murray's Portable Apparatus, for the analysis of illuminating and other gases (Patent No. 246665).

The apparatus is designed to give rapid analysis of illuminating and other gases. The absorbent solutions are kept in separate containers, and may be covered with a layer of hydrocarbon oil to prevent atmospheric action. They are drawn into the pipette by lowering the mercury in the middle vessel without risk of contaminating the pipette with oil. Connection is made between pipette and container by a short piece of rubber tubing. Analysis by explosion may be carried out in the middle vessel. The mercury can be rapidly drawn off from the latter, and as the whole apparatus then contains no liquid, it may be readily transported from place to place. The pipette is easily detached and can be removed and shaken bodily in cases where absorption is slow. The apparatus is very suitable for experimental work. (See "Journal of the Chemical Society," 127, 769, 1925, for a description of the apparatus.)

Price with one container as figured e £7 15 0

Mercury (10 lbs. required) per lb. e 5/6 ; 14 lbs. at per lb. e £0 5 3

(Price variable.)

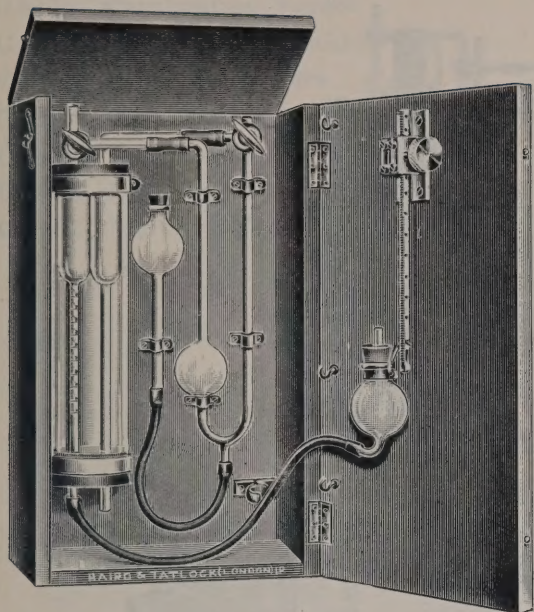
GA150 Murray's Portable Apparatus, for the analysis of illuminating and other gases (Patent No. 246665). An exact copy of the apparatus described above, but with shortened burette as in the ordinary Orsat apparatus. Price with one container e £7 0 0

GA157 Drehschmidt's Capillary Combustion Tubes of Platinum, with three palladium wires enclosed in the tube. (See "Treadwell's Analytical Chemistry," vol. ii, Fig. 105.) Price variable according to market rate of platinum. Approximately e £10 0 0



GA158

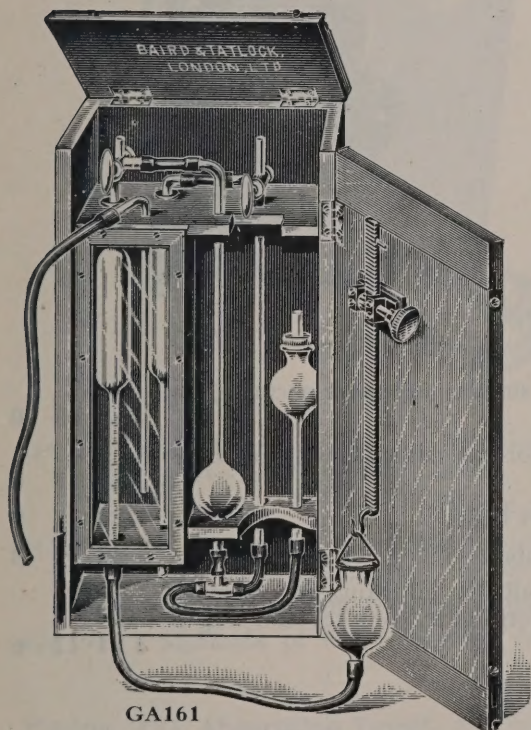
GA158 India-rubber Aspirating Pump, for use with Gas Analysis Apparatus b £0 3 0



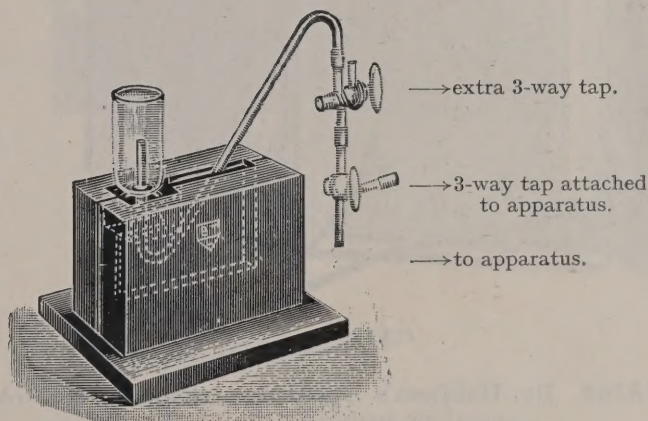
GA160 Dr. Haldane's Portable Apparatus, for the determination of CO₂ in the air of workshops and factories, etc., as illustrated on page 63, Fig. 11, "Methods of Air Analysis," 3rd edition. Modified pattern of GA161 d £5 5 0

Note.—The above standard apparatus is provided with graduated tube to read from 0.01 per cent. up to 1 per cent. (1–10000 parts), but can, if required, be supplied with graduated tubes reading up to either 2, 3, 4 or 5 per cent.; divided in 100 divisions and figured every ten divisions, showing parts per 10,000. Price as above.

GA160



GA161

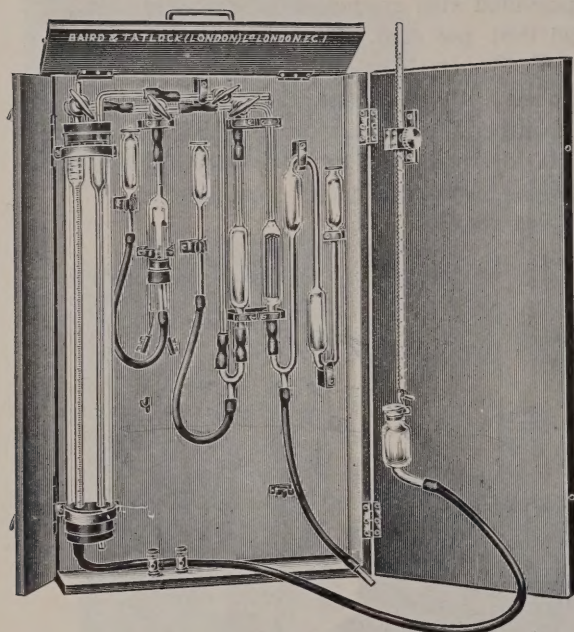


GA162/3

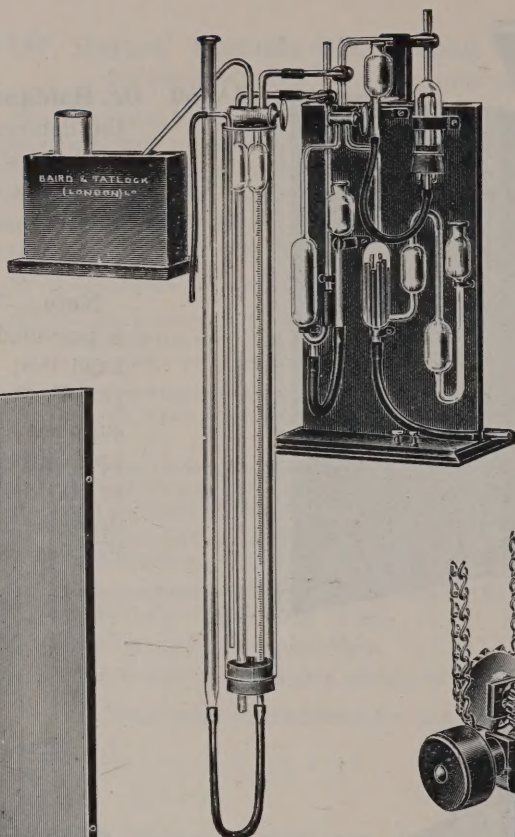


GA164

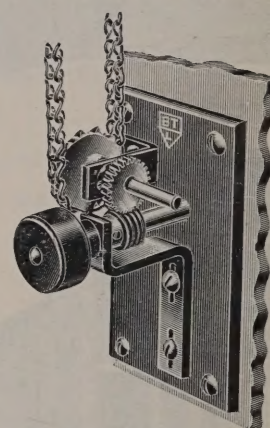
- GA161 Dr. Haldane's Apparatus**, for the determination of small quantities of CO₂ in air, portable form in mahogany case e £6 10 0
 (For full description and method of using see Blue Book containing Report of Committee on "The Ventilation of Factories and Workshops" (cd. 1302, 1902).
- GA162 Mercury Bath**, polished hardwood, for use when extracting air from 2-oz. bottles, without three-way tap A and bent capillary tube e £1 2 6
- GA163 Three-way Stopcock and bent capillary tube** e £0 5 0
- GA164 Bottles**, for taking samples of air, 2-oz., with india-rubber bands per doz. b £0 12 0



GA165



GA167



GA170

GA165	Dr. Haldane's Apparatus, similar to No. GA167, but smaller and more portable, for general air analysis	£8 8 0
GA167	Dr. Haldane's Apparatus, large laboratory pattern, for gas analysis, with mercury trough	£8 12 6
GA164	Bottles, for taking samples of air, 2-oz., with india-rubber bands	per doz. £0 12 0
GA169	Stand, with clamps, to hold water jacket and levelling tube	£0 19 0
GA170	Apparatus, devised by Wing-Commander Struan Marshall, for adjusting the mercury level in Haldane's Gas Analysis Apparatus, GA167. Worm gear, sprocket and length of chain, unmounted	£1 12 6

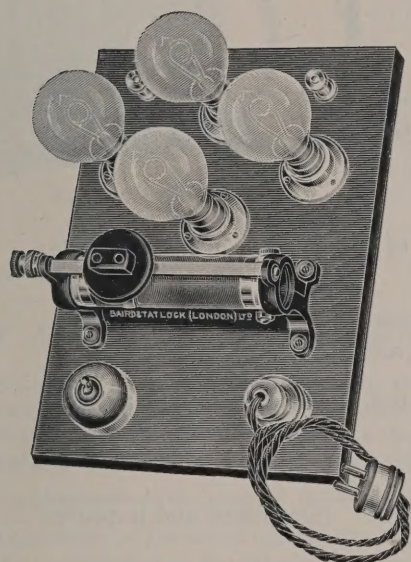
The advantages of this device are :

- (a) Infinite range of movement.
- (b) Positive drive with no possibility of slipping.
- (c) There is always a rung of the ladder in almost exactly the right place.
- (d) No fragile rack to bend.
- (e) Smooth drive.
- (f) Very fine adjustment.

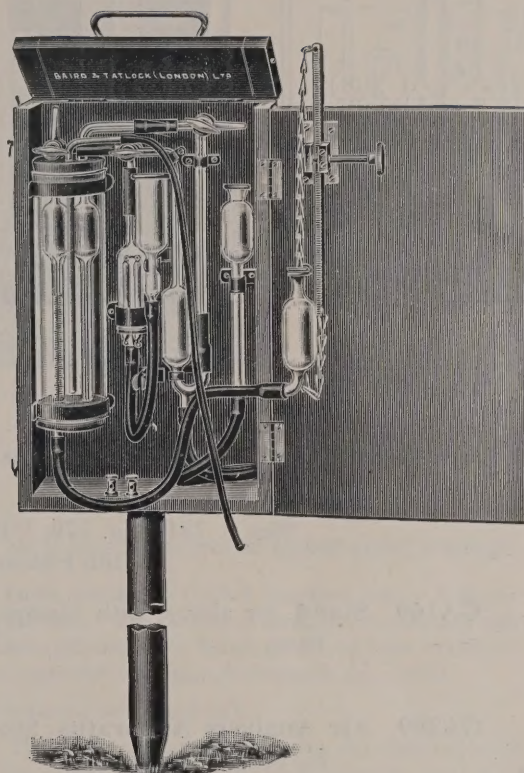
Spare Parts for GA167.

GA171	CO ₂ Absorption Vessel	} combined with stopcocks	£2 0 0
GA172	O ₂ Absorption Vessel		
GA174	Heaters for Combustion		£0 5 0

GA176	Combustion Vessel	....	....	....	....	....	....	each	e £0 10 0
GA178	Trough (water jacket)	....	....	....	....	....	....	"	e £0 7 6
GA180	Glass Reservoirs	....	....	....	....	....	....	"	e £0 2 6
GA182	Gas Burette	....	....	....	....	....	....	"	e £1 12 6
GA184	Compensator	....	....	....	....	....	....	"	e £0 2 6
GA186	Levelling Tube	....	....	....	....	....	....	"	e £0 1 6
GA162	Mercury Trough	....	....	....	....	....	....	"	e £1 2 6



GA190



GA192

- GA190 Rheostat for use with GA165, GA167 and GA192, enabling the combustion heater to be worked off the lighting circuit. Complete with plug connector and lamps as figured e £3 15 0

Please state voltage when ordering.

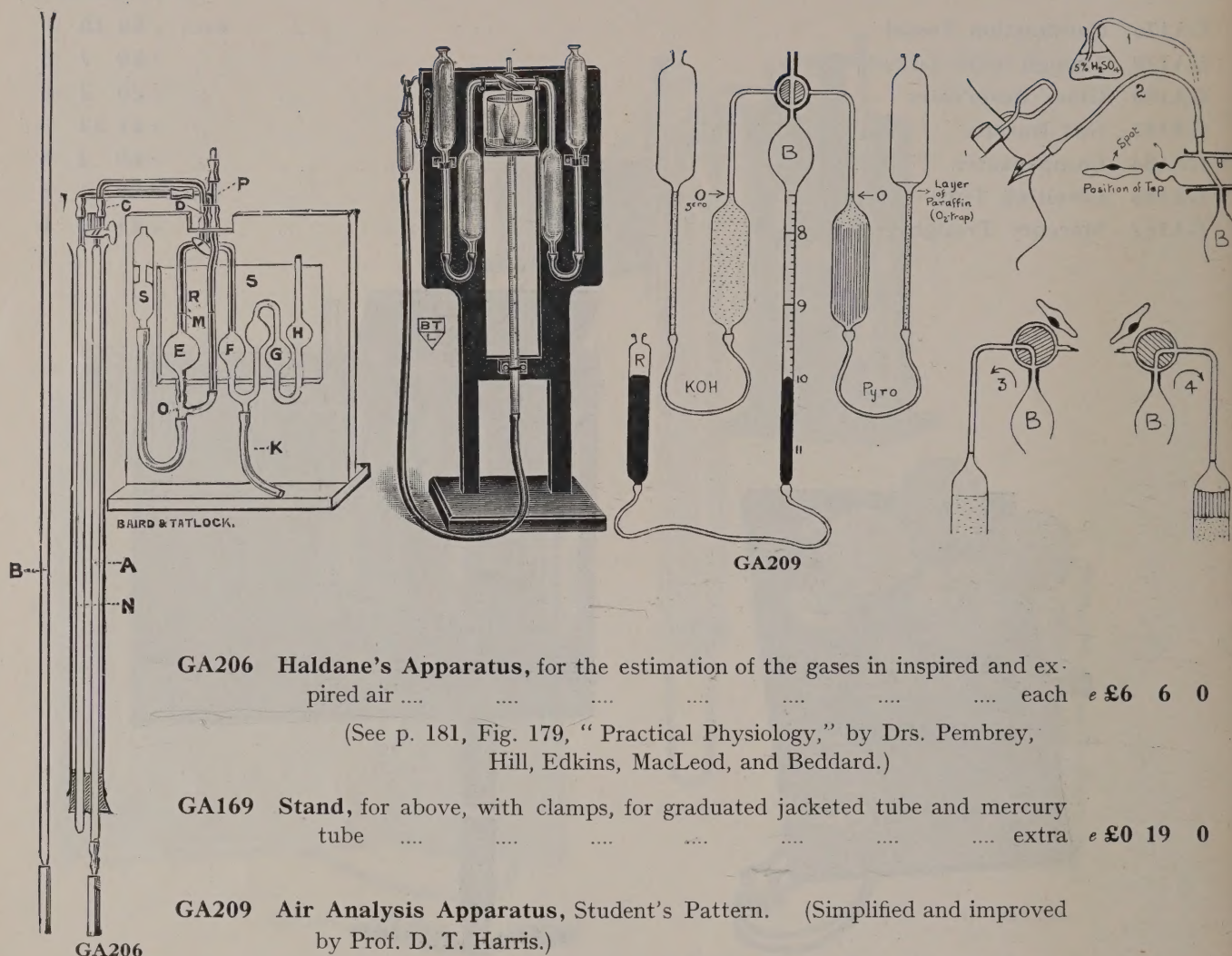
- GA192 Dr. Haldane's Apparatus, portable pattern, for determining carbon dioxide, carbon monoxide, and methane in naked light mines, with rod for screwing to case e £7 0 0

For method of working Apparatus Nos. GA160-GA192 see textbook:

- GA194 "Methods of Air Analysis," by J. Scott Haldane, M.D., F.R.S., 3rd edition n £0 6 0

Spare Parts for GA192.

GA196	CO ₂ Absorption Vessel, with stopcock	....	....	....	....	....	....	e £0 15 0
GA197	Heaters for Combustion	....	....	....	....	....	....	e £0 5 0
GA198	Combustion Vessel	....	....	....	....	....	....	e £0 2 6
GA200	Water Jacket	....	....	....	....	....	....	e £0 3 6
GA201	Glass Reservoirs (state whether for burette, absorption pipette or combustion vessel)	each	e £0 2 6					
GA202	Gas Burette	....	....	....	....	....	....	e £1 3 0
GA203	Compensator	....	....	....	....	....	....	e £0 2 6



GA206 Haldane's Apparatus, for the estimation of the gases in inspired and expired air each e £6 6 0

(See p. 181, Fig. 179, "Practical Physiology," by Drs. Pembrey, Hill, Edkins, MacLeod, and Beddard.)

GA169 Stand, for above, with clamps, for graduated jacketed tube and mercury tube extra e £0 19 0

GA209 Air Analysis Apparatus, Student's Pattern. (Simplified and improved by Prof. D. T. Harris.)

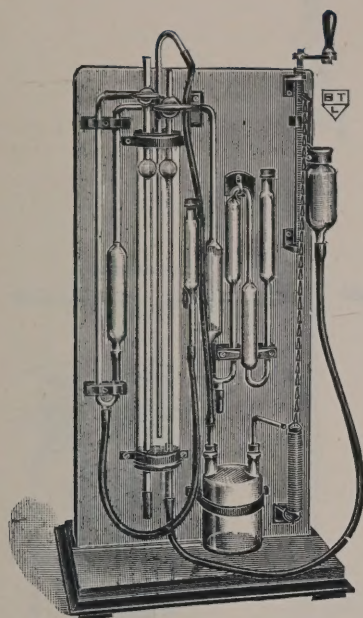
Specification.—(See "Journal of Physiology," March 1922, 55 "Proc.") The burette and absorption pipettes are made in one piece to do away with leaking rubber connections. This is firmly secured to a wooden stand. The potash and "pyro" reservoirs are easily detachable to facilitate cleaning. The gas is manipulated by a single tap with borings and spot on handle so arranged as to complete the whole analysis in one revolution in a counter-clockwise direction. Oscillations of the mercury are damped, in this pattern, by closing the reservoir with a plug of cotton-wool covered with a perforated rubber cap.

Preliminary Examination of the Apparatus.—Remove the tap and study the relation of the spot on the handle to the two borings when the tap is held in all positions 1 to 4. Rotate the tap counter-clockwise: 90° measure, 45° absorb CO₂, 45° absorb O₂, 45° measure. Clean and dry the tap and seating, smear the tap with a thin film of vaseline, clear borings, replace tap and secure with a rubber band. Leave the apparatus filled with N₂ by carrying out an analysis of room air.

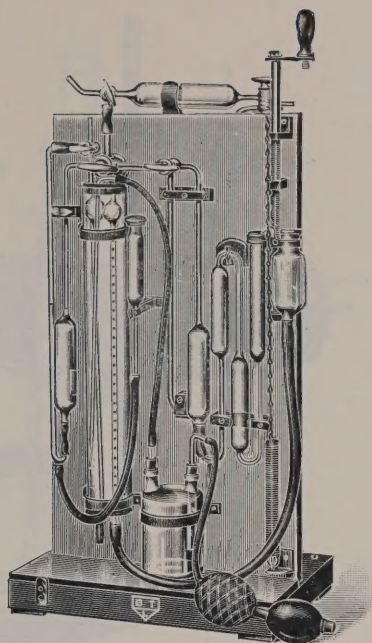
Method of Analysing Air :

- 0 Bring the absorbing fluids to the zero mark.
- 1 Clean the burette with acidified water by lowering and raising R.
- 2 Introduce 10 ml. of air into the Hempel burette ; measure the volume accurately when the mercury is at the same level in R and B.
- 3 Absorb the CO₂ in the potash bulb (10 per cent. KOH) ; measure the volume of the remaining gas. Repeat until no further absorption occurs.
- 4 Absorb the O₂ in the pyropotash bulb (10 per cent. pyrogallol in saturated KOH), repeating until no further absorption occurs.

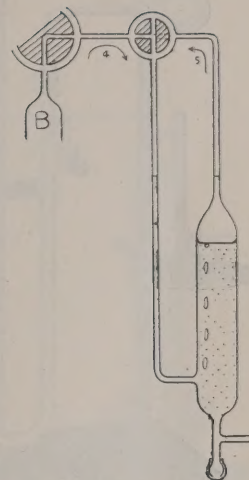
Price e £3 10 0



GA210



GA211



Rapid Absorption Bulb

GA210 Air Analysis Apparatus, modified by Prof. D. T. Harris, improved Laboratory Pattern d £6 0 0

This consists of an all-glass burette, tap and absorption bulbs, similar to GA209, together with a Haldane control tube on the potash side and a potash air-trap on the pyro side. The burette is accurately calibrated and is completely enclosed in a water jacket, the water being kept thoroughly mixed by an air jet served from a pressure bottle supplied by a Higginson syringe (the bottle but not the perishable syringe is included in the outfit).

Fine adjustment of the mercury level is rendered easy by a strong worm and nut.

The operation of the tap is exactly like that of GA209. The use of the control tube for the elimination of errors due to variations in temperature and pressure during the course of an analysis is described in Haldane's "Methods of Air Analysis," which should be consulted by all workers in this field.

GA211 Air Analysis Apparatus, Rapid Absorbing Pattern, modified by Prof. D. T. Harris.

Price without gas sampling tube d £6 12 6

A. Extra cost of electric heater and fitting d £1 10 0

The Rapid Absorption Pattern is as GA210, but has, in addition, the rapid absorption bulb. Five minutes may be saved in each analysis by causing the air to bubble up through the pyro by introducing the air via the side tube (4) and returning the N_2 (5) for measurement after suitably turning the tap.

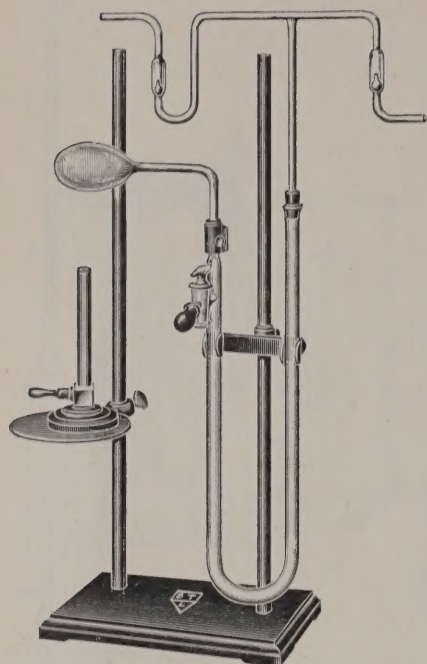
This is the pattern we recommend for speed, accuracy and ease of working. The three-way tap is so arranged that the pyro is depressed a few millimetres in **both** limbs to allow for bursting of bubbles in the bulb (no frothing ever occurs); the tap is then turned so that all the gas passes down the right limb and bubbles up through the bulb. The tap is finally turned so that the gas returns along the bulb tube for measurement in the burette. This tap is also useful in shutting off the pyro, thus preventing it from being sucked over by accident.

Absorption of the oxygen is **complete** in five passages of the gas through the pyro, thus reducing the time by less than half—there being no necessity to allow any standing of the gas at all.

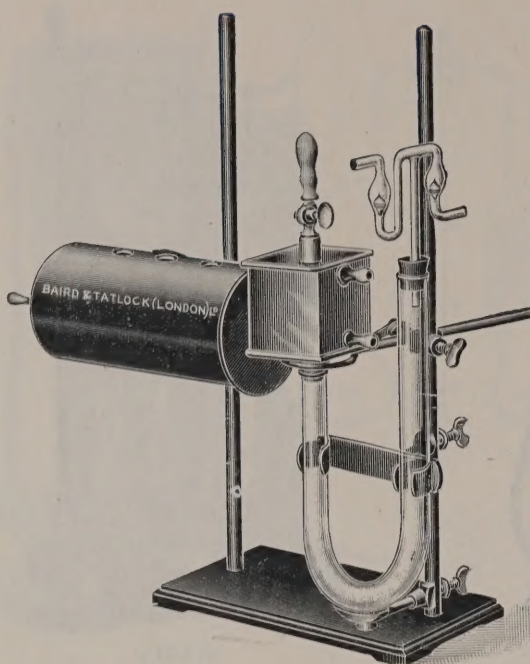
The time of absorption may be still further reduced by means of a small electric heater.

Kindly state voltage when ordering the electric heater.

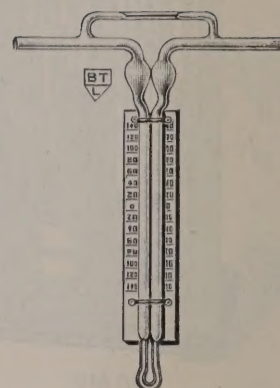
GA212 Gas Sampling Tube, as figured in clip at top of stand in No. GA211 d £0 17 6



GA214



GA219



GA224

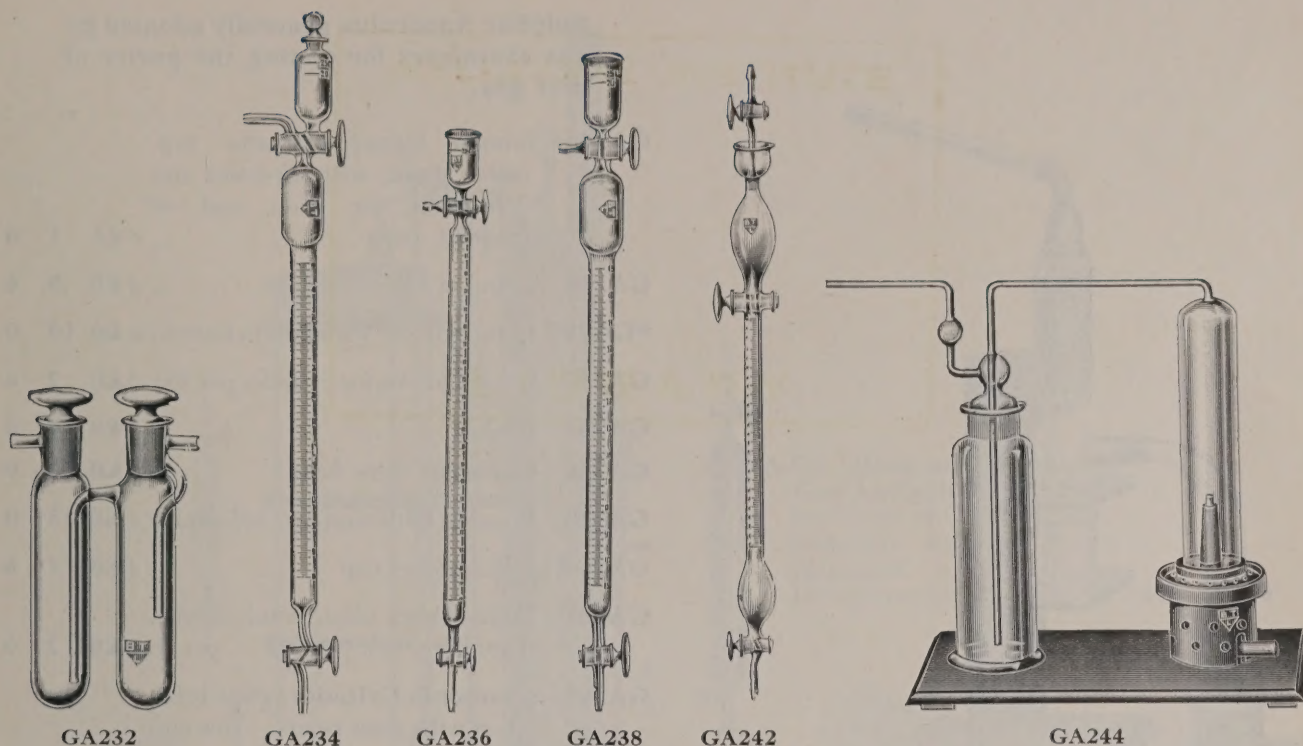
"METRO" GAS CIRCULATOR.

This apparatus was originally devised by A. R. Pearson and J. S. G. Thomas of the South Metropolitan Gas Company for the purpose of circulating a volume of gas through a closed system (see "Journal of the Chemical Society," 1925, vol. 127, page 2450), but as a circulating air pump many other useful applications of the apparatus will be found in the laboratory. Two forms of the apparatus are made: the smaller will drive about 2 cubic feet of gas per hour against a back pressure of about 3 inches of water, and the larger pattern about 4 cubic feet per hour against a back pressure of 5 inches. Closed circuits should contain a capacity vessel of about 500 ml. on each side of the circulator. The rate of circulation may be controlled either by means of a bypass tube with stopcock or by a choke tap on the limb of the U-tube. The pressure and rate of flow of the gas may be measured by inserting a flowmeter in the circuit.

Directions for operating "Metro" Gas Circulators.

The hot-air chamber is made of clear silica in the small circulators and of calorised iron in the larger ones. It is raised to a red heat and the starting-cock is then opened so as to equalise the pressure on both sides of the U-tube. A small rubber bulb (such as is used for filling fountain pens) is then slipped over the outlet of the starting-cock, and the mercury is set in oscillation by alternately squeezing and releasing this bulb. The cock is then closed, and the mercury will continue to oscillate. The best results are obtained when the mercury at each stroke nearly reaches the mouth of the tube leading to the hot chamber.

GA214	"Metro" Gas Circulator, small pattern, with silica bulb, on stand with burner	....	d £3 3 0
GA215	"Metro" Gas Circulator, small pattern, with silica bulb, on stand with electric heater	....	d £4 15 0
Please state voltage when ordering.			
GA216	"Metro" Gas Circulator, small pattern, with silica bulb, without stand and burner	....	d £1 15 0
GA217	"Metro" Gas Circulator, as GA214, but with the addition of a bypass stopcock and two capacity vessels with fittings	....	d £3 12 0
GA218	Spare Silica Bulbs	 each	d £0 14 0
GA219	"Metro" Gas Circulator, large pattern, with calorised iron heater, burner with screen and cooling arrangement. Complete on stand as illustrated	....	d £8 8 0
GA220	"Metro" Gas Circulator, as above, but with the addition of a bypass stopcock and two capacity vessels with fittings	....	d £9 0 0
GA222	Stopcock fitted to second limb of the U-tube (useful when system requires to be evacuated for introduction of the gas and for controlling the rate of flow).		
	A. Small size, GA214-GA216	 extra	d £0 5 0
	B. Large size, GA219-GA220	....	d £0 6 0
GA224	Flowmeter, for measuring the pressure and rate of flow of the gas	....	d £0 18 6



- GA232 Absorption Tubes, for moisture and carbon-dioxide c £0 13 6
- GA234 Bunte's Gas Burette, improved, patent stopcock, graduated 15 to 0 and 0 to 45 ml.
in fifths c £1 2 6
- GA236 Bunte's Gas Burette, with two stopcocks, the tap at top being a three-way stop-cock,
graduated 10 to 0 and 100 ml. in fifths each c £1 0 0
- GA238 Bunte's Gas Burette, same as above, but with bulb under stopcock, graduated 15 to 0
and 0 to 45 ml. in fifths c £1 0 0
- GA240 Hempel's Gas Burette, unaffected by temperature and alteration of atmospheric
pressure; with patent stopcock. Price complete with stands c £2 17 6
(See "Berichte der deutschen Chemischen Gesellschaft," xx, No. 13.)
- GA242 Franke's Gas Burette, modified form, graduated to 100 ml. c £1 15 0
- GA244 Apparatus for estimating Sulphur Compounds in coal gas, involving the use of a
specially constructed chimney

Gas is burnt in a chimney, and the combustion products are drawn through a 0.1 N solution of Na_2CO_3 by means of a vacuum pump.

The sulphur compounds combine to form Na_2SO_3 . The excess Na_2CO_3 is titrated with 0.1 N H_2SO_4 , and the amount of soda found to have been used gives a measure of the sulphur compounds in the gas. For gas of from 20-30 grains of S/100 c. ft. two wash bottles each containing 50 ml. of 0.1 N Na_2CO_3 are sufficient.

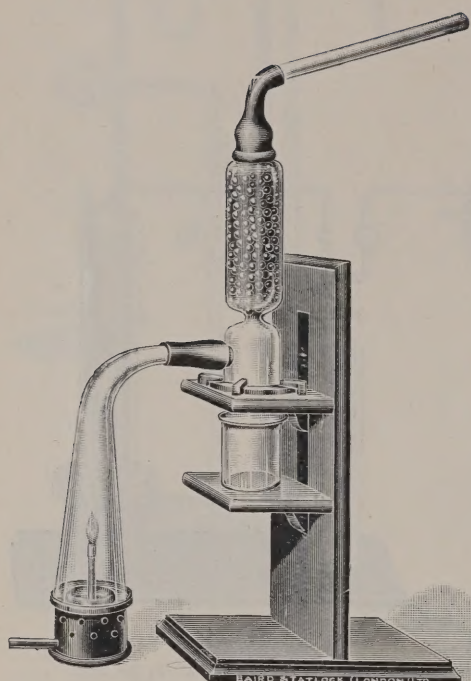
The results obtained by this method show very close agreement with those obtained by the ordinary referees' test.

The chief advantages which we claim for this method are its extreme simplicity and the accuracy and celerity with which it may be worked—4 ft. of gas are quite sufficient, though the volume of gas may be easily extended to 8 or 10 ft.

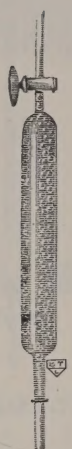
Price d £2 10 0

Page 1143

Sulphur Apparatus generally adopted by gas examiners for testing the purity of coal gas.

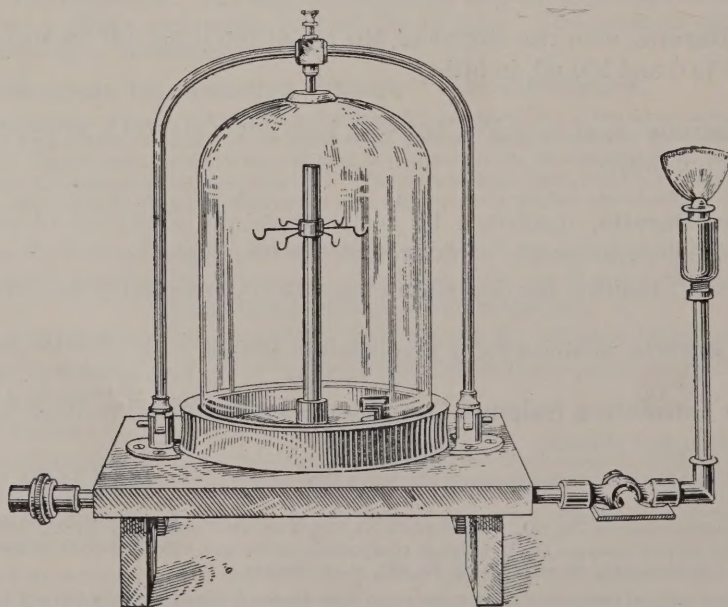


GA246-GA248



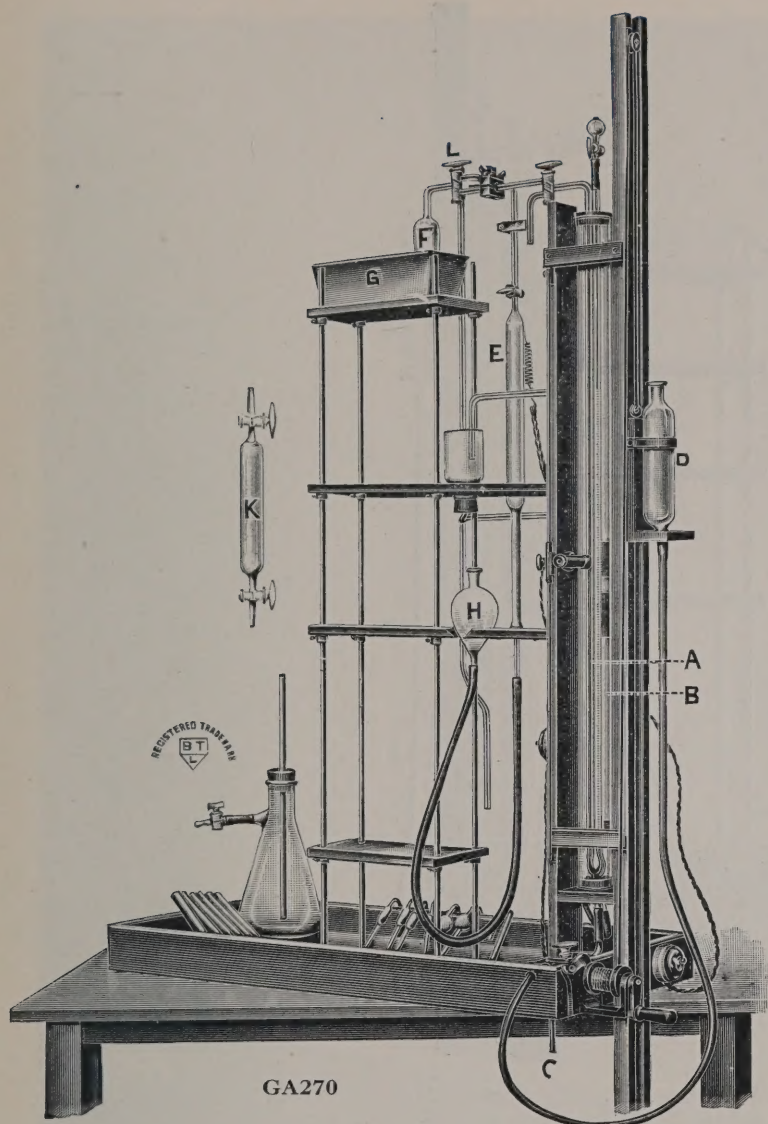
GA262

- | | | | | | | |
|--------|---|------|--------|-----------|----|------|
| GA246 | Bunsen burner, steatite top, metal stand, with air-holes and depression for wide end of trumpet tube | .... | .... d | £1 | 1 | 0 |
| GA248 | Trumpet tube | .... | .... d | £0 | 5 | 6 |
| *GA250 | Glass cylinder with hole in bottom | .... | .... d | £0 | 10 | 0 |
| GA252 | Glass marbles for cylinder per 100 | .... | .... d | £0 | 2 | 6 |
| GA254 | Beaker | .... | .... d | £0 | 1 | 0 |
| GA256 | Condenser tube, bent | .... | .... d | £0 | 5 | 0 |
| GA258 | Wooden table support, adjustable | .... | .... d | £0 | 15 | 0 |
| GA260 | India-rubber cap | .... | .... d | £0 | 1 | 6 |
| GA261 | India-rubber tube to suit above, 1-in. bore | .... | .... | per ft. b | £0 | 2 6 |
| GA262 | Ammonia Cylinder, glass tube, filled with glass beads. One end of tube is closed by a stopcock, and the other by a tube ground to fit | .... | .... | .... d | £0 | 16 0 |
| GA263 | Wooden Stand for ammonia cylinder | .... | .... | .... d | £0 | 7 6 |



GA266

- GA266 Sulphuretted Hydrogen Test Apparatus, Gas Referees' Pattern, complete with mercury, test papers and governor-burner passing gas at the prescribed rate d £4 10 0

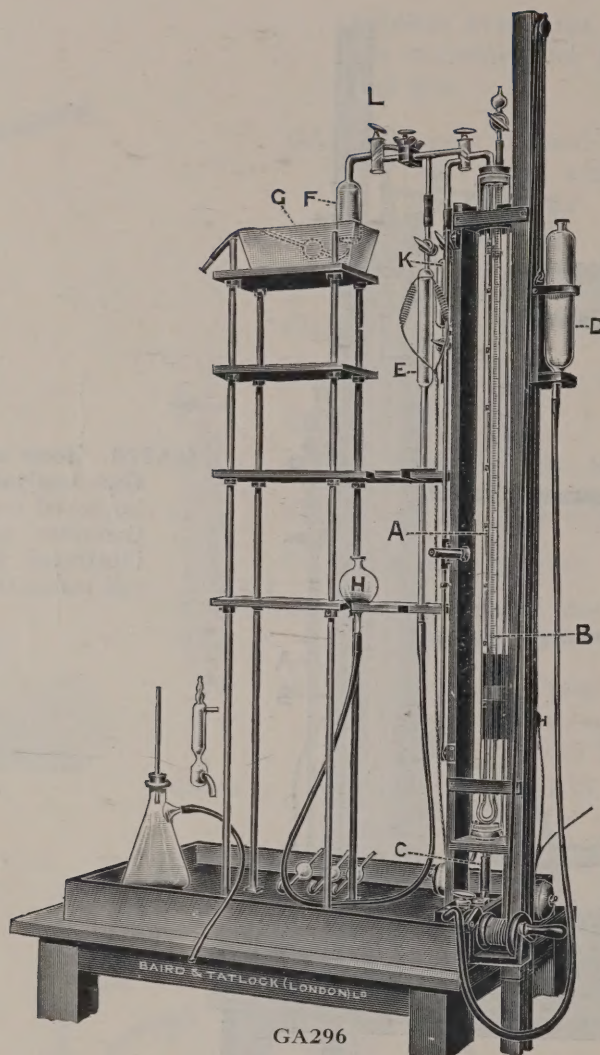


GA270 Bone and Wheeler's Gas Analysis Apparatus,
improved ordinary pattern.
Complete with 16 page
illustrated booklet giving
full instructions for use £28 10 0

Spare Parts.

GA272	Graduated Tube, with taps and flange for absorption vessel (flange for explosion tube supplied but not fused on), without water jacket	£3 2 0
GA273	Explosion Tube, with flange, without rubber tubing and reservoir	£1 6 0
GA274	Absorption Vessel, with taps and flange	£0 19 0
GA275	Pressure Tap, with fine adjustment and spring for bottom of measuring tube	£0 7 6
GA276	Cylindrical Reservoir, for measuring	£0 3 6
GA277	Telescope Reading Arrangement, complete with rod and bracket....	£1 5 0
GA278	Lamp Carrying Arrangement, with glass screen, square rod and bracket	£1 5 0
GA279	Porcelain Mercury Trough	£0 17 0
GA280	Length of Catgut	£0 7 0
GA281	Pipette, with piece of rubber tubing	£0 1 0
GA282	6 ft. Canvas-lined Pressure Tubing	£0 18 0
GA283	Clips, for ground glass flanges	£0 4 6

For list of Reagents required see Chemical Section XXXI.



GA296

GA296 Bone and Wheeler's Apparatus for Mine Air. As described in the Third Report of the Home Office Explosions in Coal Mines Committee.

Official pattern as adopted as standard by Coal Mines Committee.

Price complete on teak stand with the following accessories :

Reading Lens arrangement,
Graduated Laboratory Vessel,
Gas Sampling Tube with three-way Tap,

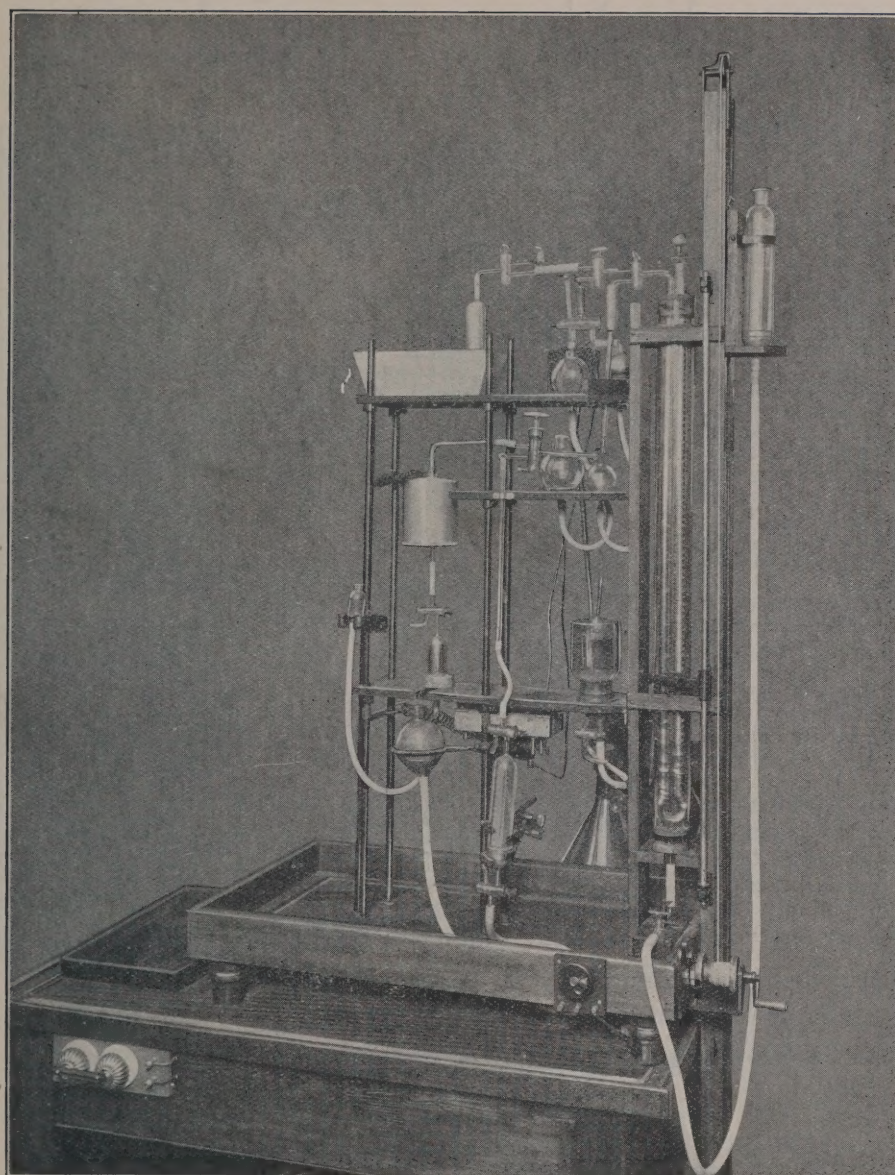
Registered Spring Tap with fine adjustment,
4-volt Osram Lamp and fittings,
Water Pump, Flask and I.R. Tubing

.... e £28 10 0

The following extras can be supplied, if required, at prices stated :

GA297	7 Bottles for Reagents with sand blast labels and stoppers for pipettes	....	....	e £1 1 0
GA298	2 Gas Sampling Tubes in polished case	....	....	e £2 2 0
	or			
GA299	6 " " " " "	....	....	e £4 10 0
*GA300	1 Induction Coil	....	....	e £1 1 0
GA301	1 Stand with 6 tubes and crucibles	....	....	e £0 17 6
GA302	1 Electrolysis Apparatus with plate electrodes for making electrolytic gas $2H_2 + O_2$	....	....	e £1 12 6

For list of Reagents required see Chemical Section XXXI.



GA310

Bone and Wheeler's Gas Analysis Apparatus, modified by J. G. King, as used at the Fuel Research Station, Greenwich.

This apparatus is a modified form of the Standard Bone and Wheeler's Apparatus. In addition it contains all the modifications which have been incorporated at the Fuel Research Station. The chief of these are :

(1) An auxiliary furnace for the combustion of CO and H₂, as described in Fuel Research Technical Paper No. 33 (Department of Scientific and Industrial Research).

(2) The provision of a residue storage vessel to enable more than one explosion to be done on gas residues.

(3) A special explosion vessel to give a greater certainty of complete combustion.

Many of the improvements are included which make for greater efficiency and ease of working.

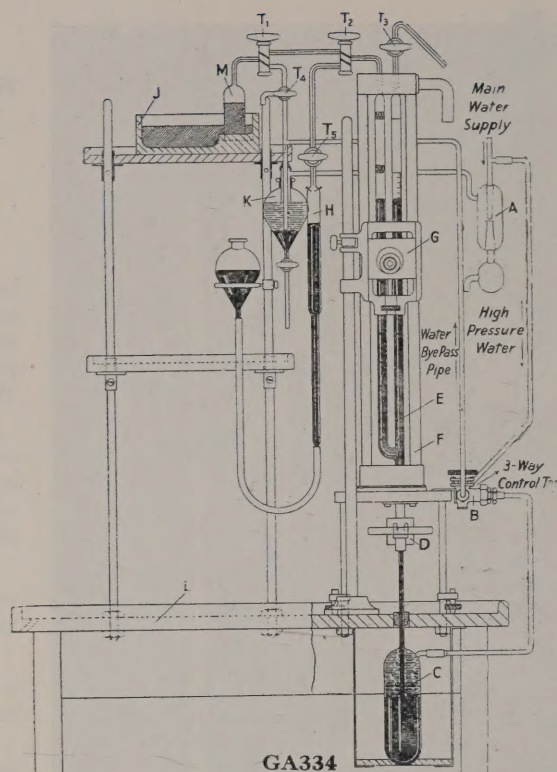
GA310 Apparatus, complete as figured, with electric furnace, special regulator to control temperature at 300° C., 600° C. or 900° C., induction coil, battery switches, and all necessary tubing and connections, but without mercury (please state voltage) e £50 0 0

Mercury (about 30 lbs. required). Price variable, per lb. e 5/6 ; per 14 lbs. at e £0 5 3

Spare Parts of Bone and Wheeler's Gas Analysis Apparatus, GA310.

GA312 Pressure and Measuring Tube e £3 15 0	GA324 Spare Heaters for furnace. Consumption in watts, 250 each e £1 1 0
GA314 Water Jacket for do. e £0 10 0	GA325 Mercury Trough e £0 17 0
GA316 Absorption Vessel e £1 4 0	*GA300 Induction Coil e £1 1 0
GA317 Gas Sampling Tube, with three-way stopcocks e £0 19 6	GA327 Overflow Vessel e £0 3 6
GA318 Explosion Vessel e £1 5 0	GA328 Reservoir for GA312 e £0 3 6
GA320 Residue Storage Vessel e £0 2 0	GA329 Reservoir for GA318 e £0 2 6
GA321 Silica Combustion Tube h £1 5 6	GA330 Reservoir for GA320 e £0 1 6
GA322 Stopcock, three-way, to connect same to measuring vessel e £0 10 0	GA331 Reservoir for GA323 e £0 1 6
GA323 Auxiliary Vessel, with three-way stopcock (below silica tube) e £0 10 6	GA332 Stevens' Rubber Grease, for lubricating the stopcocks per tin e £0 1 6 per dozen tins e £0 17 6

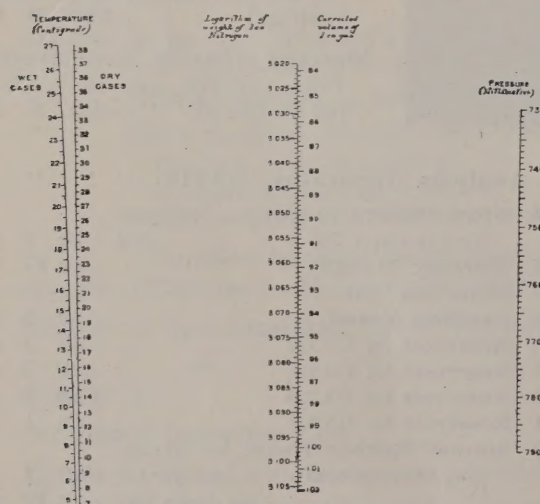
For list of Reagents required see Chemical Section XXXI.



GA334

GA334 Bone-Newitt Gas Analysis Apparatus, comprising teak table carrying metal water jacket with plate-glass sides, special steel mercury tap for fine adjustment, two-way tap for pressure and suction with copper tubing for connection, Porro prism erector telescope with fine adjustment, fitted on bracket for sliding on rod, measuring tubes with taps and ground flange connections with clip for explosion tube and for absorption vessel, porcelain trough and mercury reservoirs, etc., complete with instructions for use £51 0 0

(See "Gaseous Combustion at High Pressure," by W. A. Bone and D. M. Newitt, for further details.)



GA335

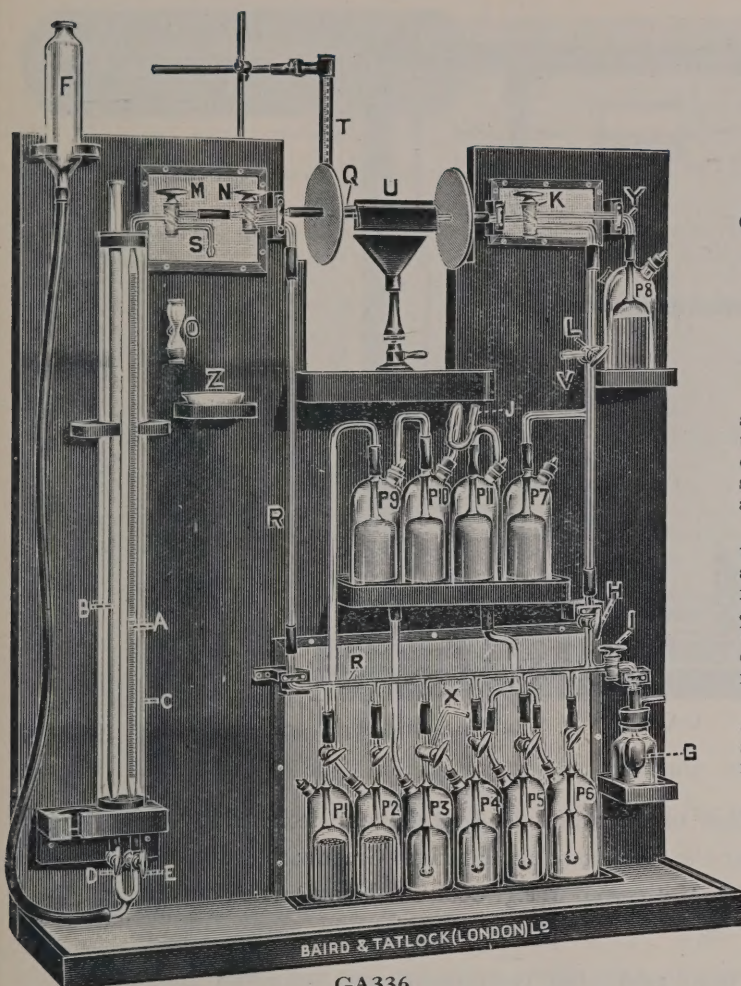
GA335 Farmer's Gas Calculator. A graphic method for the correction of gas volumes, especially for nitrogen determinations. For the use of teachers, students, and all chemical works in which gas analysis or nitrogen determinations are required. By R. C. Farmer, D.Sc., Ph.D. Published by Baird & Tatlock (London) Ltd. £20 5 0

Much time is lost in the recalculation of gas volumes to normal temperature and pressure: and even when tables of corrections are used, interpolations are generally necessary.

By the use of this graphic method the corrected volume of 1 millilitre of gas, either wet or dry, can be found with an accuracy of about 2 parts in 10,000 in one single operation, thus eliminating all errors and effecting a great saving of time in all work on gases.

A cursor is laid across the diagram joining the points indicating the temperature and pressure at which the gas was measured, and the corrected volume is read off directly. Conversely, the temperature or pressure can be found if the volume is known. The logarithm of the corrected weight of nitrogen can be read off at the same time, thus reducing the calculation of nitrogen percentages to a very simple operation.

A series of tables relating to gasometric work and a set of logarithms are attached to the diagram in a convenient form for reference in conjunction with the calculator.



GA336

GA336 Connolly's Thermo-Fractional Gas Analyser, for complete analyses of simple or complex gaseous mixtures, designed by A. W. Connolly. Price £29 10 0

The accuracy and interpretation of gas analyses is becoming more and more an essential question of investigation, and the difficulties inherent in the explosion method, with subsequent liability to error, are also widely appreciated.

The apparatus is of the industrial type and was developed to meet the requirements for the accurate analysis of simple or complex gaseous mixtures. It embodies methods adopted by Jaeger (J. Gasbeleucht, 1898) for the combustion of inflammable gases over heated copper oxide, and in addition possesses some novel features.

The absorption pipettes (some of which are of a new bubbling type) are of robust construction and are designed for efficiency and rapidity.

SALIENT FEATURES OF THE APPARATUS.

1. The elimination of error due to the evolution of oxygen during the determination of unsaturated hydrocarbons.
2. The accurate determination of carbon monoxide in two stages.
3. The direct determination of hydrogen.
4. The direct and indirect determination of saturated hydrocarbons.
5. The direct and indirect determination of nitrogen.
6. No "dead" space exists in the capillaries.
7. The apparatus is simple both in construction and manipulation, and in it a gas analysis may be completed in forty-five minutes.

We are the Sole Manufacturers of this Apparatus, and shall be pleased to forward complete description and method of manipulation upon request.

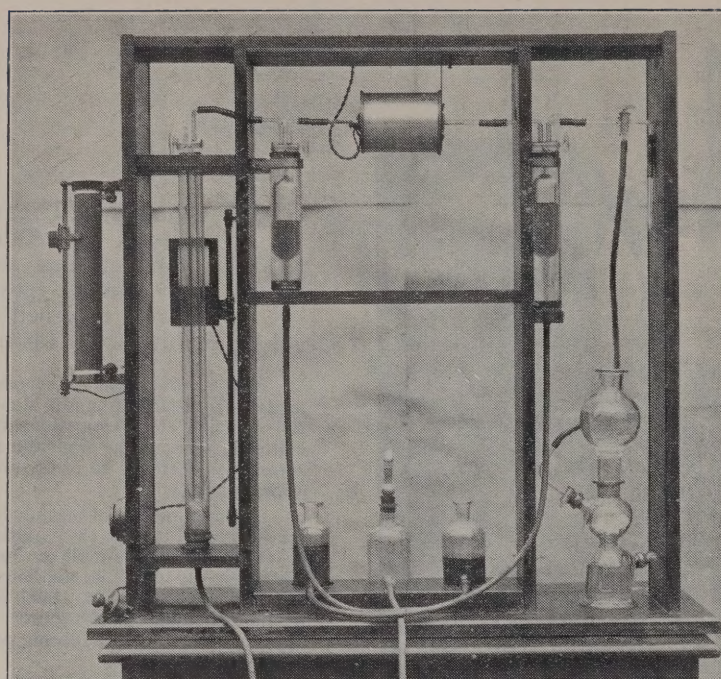
GA338 Connolly's Absorption Pipettes for Adaption to Orsat Apparatus (developed by A. W. Connolly).

These absorption pipettes are simple in manipulation and are of a single limb design; they offer advantages both in robustness and cleanliness over the usual double limb type. Type A, as P6 in above illustration, is of a bubbling design, with double bore stopcock; it ensures far greater rapidity and efficiency of carbon monoxide absorption over the usual surface absorption type. There is no possibility of loss of gas occurring during its operation. Also the changing of solutions and cleaning of pipettes are done with absolute ease. Thin strips of copper are intended to be admitted through the tubulure and directed down the outer side of the inner container. Type B, as P1, but with single-way tap, is recommended for use with cadmium chloride, caustic potash and pyrogallie solutions. This pipette does away with the customary troublesome attachment of the taps to the capillary rail. Type C, as P8, can be conveniently adapted to the usual tap rail.

Type	....	....	A
Price	....	....	£ 25/-

B
£ 17/6

C
£ 13/6



GA340

GA340 Apparatus for the Direct Determination of Nitrogen in Fuel Gases, designed by J. G. King. The apparatus is in use at the Fuel Research Station, Greenwich. It is simple, rapid, and effective, an estimation of nitrogen in *e.g.* Coal Gas being carried out in approximately fifteen minutes.

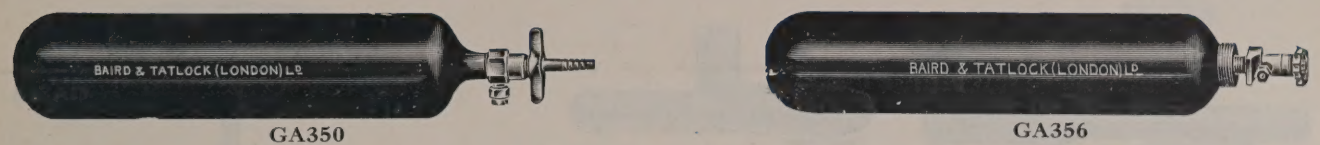
The gas is measured in the right-hand bulb, which has been previously calibrated to 100 ml. The tubes, furnace, and all connections are swept out by means of carbon dioxide, a two-way stopcock being provided for this purpose. The furnace is raised to a temperature of 900° C. and the gas circulated back and forth between right and left-hand bulbs until all combustible gases have been oxidised. The gas residue is then washed from the two bulbs and the connections by means of carbon dioxide into the burette, which contains caustic soda for the absorption of carbon dioxide. The residual nitrogen is measured in the usual way. The combustion tube is made of silica and contains copper oxide. Its temperature may be measured by means of a thermocouple. The stopcock on the burette should be carefully watched, since it tends to stick with caustic soda solution. The confining liquid in the circulating bulbs is a saturated solution of magnesium chloride.

Price of complete apparatus, mounted on stand as illustrated, with furnace, regulating resistance, silica combustion tube, Kipp's apparatus, but without confining liquids e £13 17 6

Please state voltage when ordering.

GA342 Spare Silica Tubes, transparent each e £0 18 0

*GA344 Kipp's Apparatus, 3-in. centre bulb (SC6263) ,, b £1 4 0



GA350 Seamless Steel Cylinders (tested to a pressure of 120 atmospheres).

Cubic Contents in feet.	Approximate External Diameter in inches.	Approximate Length Overall in inches, excluding Valve.	Approximate Weight in lbs. (Empty).	Prices of Cylinders with Valve.
10	4	19	13	<i>e</i> £2 5 0
12	4	23	15	<i>e</i> £2 6 0
20	4	35	23	<i>e</i> £2 7 6
40	5½	36	45	<i>e</i> £3 7 6
60	5½	50	66	<i>e</i> £3 10 0
60	7	32	66	<i>e</i> £3 10 0
80	7	41	88	<i>e</i> £4 1 0
100	7	49	110	<i>e</i> £6 0 0

Nipple, union and cylinder valve key, extra, *e* 10/-.

GA351 Oxygen.	In Cylinders on Loan.	Rent per Week after 14 Days.	In Customer's own Cylinders.
Quantities of less than 30 cu. ft.	<i>e</i> 5d. per cu. ft.	<i>e</i> 1/3	<i>e</i> 4½d. per cu. ft.
" 30 cu. ft. and less than 60 cu. ft.	<i>e</i> 4d. " "	<i>e</i> 1/6	<i>e</i> 4d. " "
" 60 cu. ft. and upwards	<i>e</i> 3d. " "	<i>e</i> 2/6	<i>e</i> 2½d. " "

GA352 Nitrogen. Same prices as above.

GA354 Hydrogen in steel cylinders, supplied at same prices as oxygen. (See GA351.)

GA355 Coal Gas, supplied at ½d. per cu. ft. less than the price of oxygen.

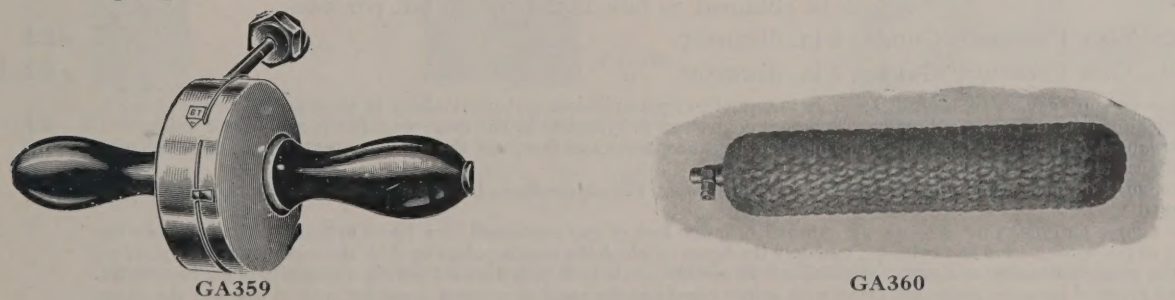
GA356 Carbon Dioxide, in cylinders.			
Size of cylinder	10	20	40 cu. ft.
Weight of gas	3	7	16 lbs.
Price of gas only, per cylinder	<i>e</i> 8/-	<i>e</i> 10/-	<i>e</i> 13/6

Price for gas cylinders same price as oxygen cylinders, No. GA350.

These cylinders cannot be supplied on loan.

GA358 Carbon Dioxide, in cylinders of 28 lbs., ready filled	<i>e</i> £6 13 6
Price of cylinder only	<i>e</i> £5 15 0

If required for aeration, ordinary fittings will do, but if for the production of solid CO₂ a special tube to bottom is necessary. Please state which is required.

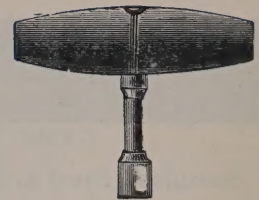
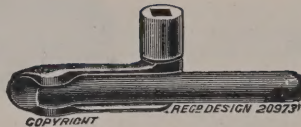


GA359 Metal Box, nickel-plated, for the production of solid CO₂, with jet and coupling *b* £2 10 0

GA360 Hemp Covers, for transport of cylinders by rail.								
Size of cylinder	10	12	15	20	40	60	80	100 cu. ft.
Price	<i>e</i> 7/6	<i>e</i> 7/6	<i>e</i> 8/-	<i>e</i> 8/6	<i>e</i> 12/6	<i>e</i> 18/6	<i>e</i> 21/-	<i>e</i> 25/- each



GA362



GA364

GA362 Folding Key Lever, steel throughout.

A. Black....	.....	each	e £0 4 0
B. Nickel-plated ....	.....	„	e £0 5 6

This key is principally sent out with hired cylinders. When the lever is extended, an increased power is obtained for opening the valve. When closed, an ordinary T-handle is formed, thus giving reduced leverage for closing the valve, thereby preventing injury to the valve seating. The construction also prevents the valve spindle being turned the wrong way in opening or closing the valve.

GA364 Valve Key, wooden handle		each	e £0 6 0
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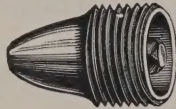
Fittings for Oxygen Cylinders have right-hand thread and are painted black.

Fittings for Hydrogen and Coal-Gas Cylinders have left-hand threads and are painted red.

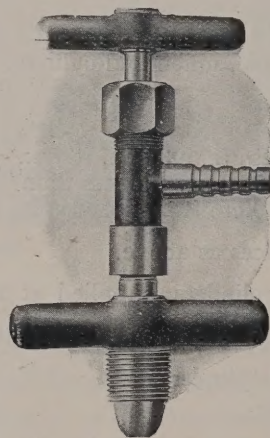
Please state which are required when ordering.



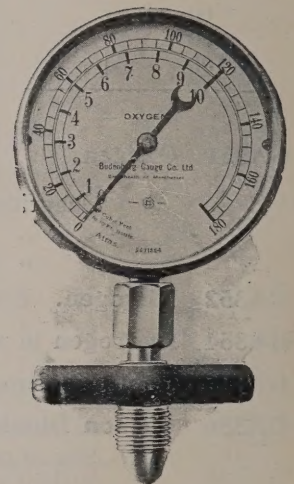
GA366



GA368



GA370



GA372-GA374

GA366 Gland Nut Spanner		each	e £0 2 0
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This spanner is useful for tightening up the gland nut of cylinder valves when a leakage of gas is observable round the valve spindle. Cylinder owners should possess one, but it is not supplied with hired cylinders.

GA368 Plug for Cylinder Valve Socket		each	e £0 1 6
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This plug is useful to prevent injury to a valve socket. It can be screwed in and out of the valve socket by means of the ordinary valve key. It is not supplied with hired cylinders.

GA370 Fine Adjustment Valve, large pattern		each	e £0 14 6
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Can be obtained on hire at the cost of 6d. per week.

GA372 Gas Pressure Gauge, 4 in. diameter		„	e £3 3 0
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GA374 Gas Pressure Gauge, 3 in. diameter		„	e £2 12 6
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These pressure gauges are useful to frequent users of oxygen cylinders and particularly to agents, as a means of ascertaining the quantity of gas in cylinders. They are connected to cylinders in the same way as the nipple and union.

The gauges, as illustrated, are specially marked in atmospheres and feet, and the cubic contents of any cylinder may be readily calculated in the following manner:

The figures on outer ring indicate pressure in atmospheres, 120 atmospheres being the pressure to which all cylinders are charged.

The figures on inner ring indicate the number of cubic feet of gas contained in a 10-ft. cylinder. To calculate the quantity of gas contained in any cylinder, multiply the figure to which the needle points by $\frac{1}{10}$ of the capacity of the cylinder; thus if the gauge is attached to a 40-ft. cylinder, and the needle points to 6, then $6 \times 4 = 24$ cu. ft. = quantity of gas in cylinder.

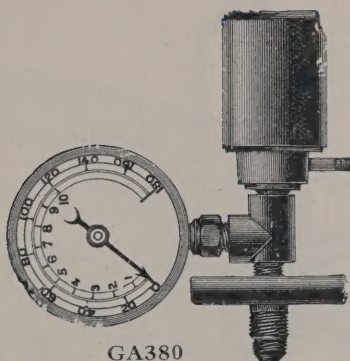
Both types of pressure gauge are fitted with safety checks in the stem to prevent a sudden rush of gas into the gauge tube when the cylinder valve is opened.

Not being makers of pressure gauges, we do not guarantee these articles in any respect. They are only supplied subject to the purchaser accepting all risk (if any) in respect of them.

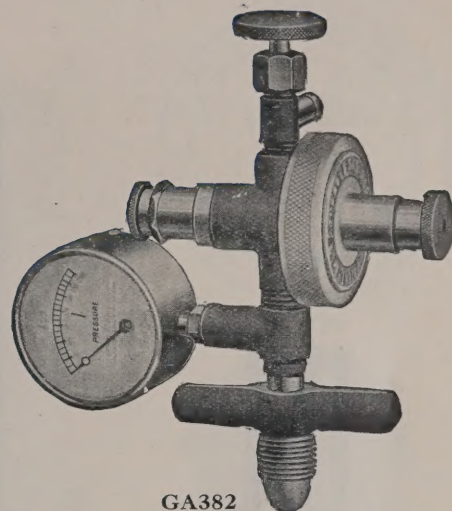
When ordering accessories for CO₂ Cylinders, name of maker of cylinder must be stated.



GA376



GA380



GA382

GA376 Beard's Automatic Pressure Regulator, 2 $\frac{3}{4}$ in. each e £1 12 6

Can be obtained on hire at the cost of 1/- per week.

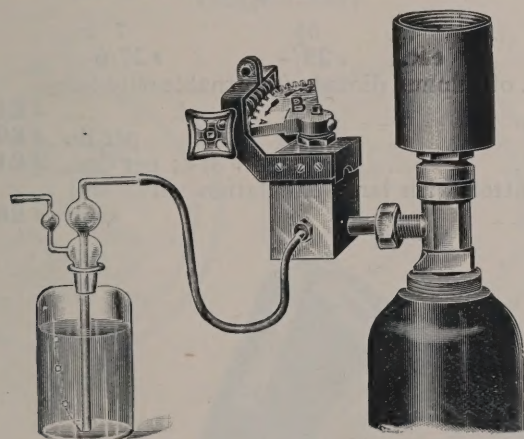
GA378 T-piece, as shown, to combine regulator and gauge e £0 12 6

GA380 Beard's Regulator, T-piece and Pressure Gauge, as figured e £3 14 0

This regulator is extensively used in lantern work. It reduces and automatically controls the pressure and flow of gas from the cylinders, so that after the cylinder valve is opened the gas may be regulated by the taps on the limelight jet.

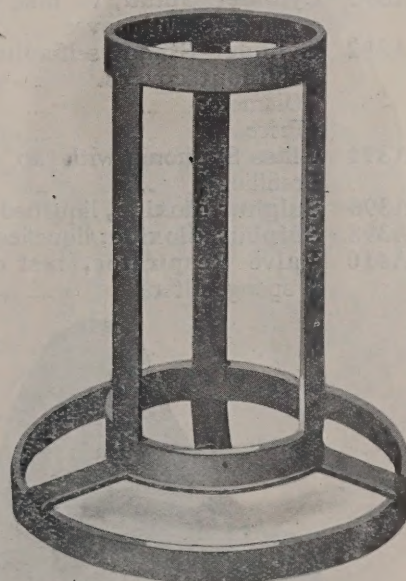
GA382 Endurance Automatic Pressure Regulator
each e £1 15 0

If fitted with high-pressure gauge to register
the contents of cylinder extra e £0 12 6



GA384

GA384 Fine Adjustment Valve for connecting to CO₂ cylinders. The opening is so extremely small that the movement of the segment (B) which controls the valve can easily be regulated by means of the cog-wheel and handle. e £3 18 6



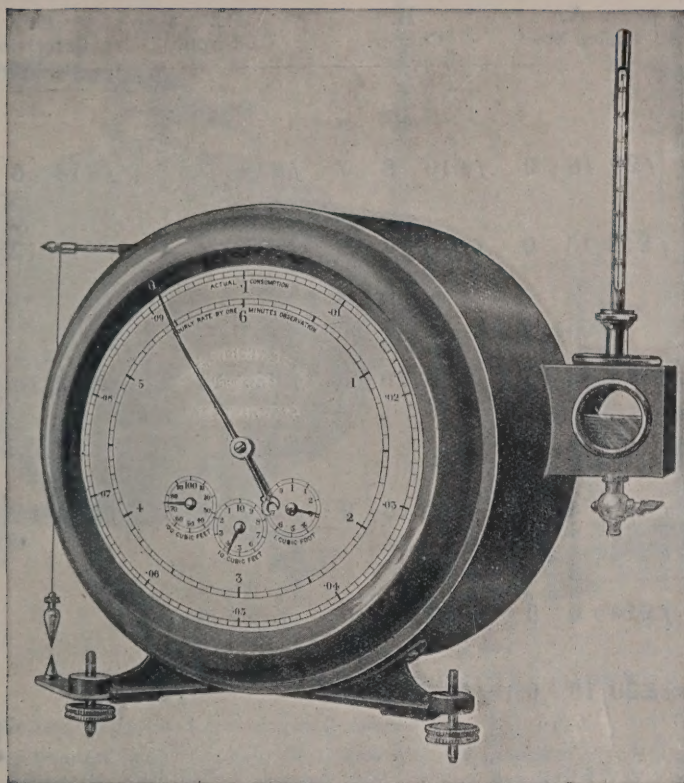
GA386

Note.—Please state exact dimensions of thread and maker's name on cylinder when ordering.

GA386 Cylinder Stand, suitable for 20-cu. ft. cylinders and upwards.

Diameter	.....	4-6	8 in.
Price	.....	each e 17/6	e 27/6

In ordering please state the capacity of cylinder, and if fitted with hemp cover.



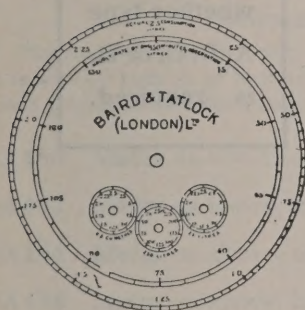
GA420-GA442



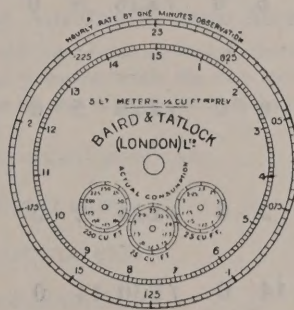
GA422



GA424



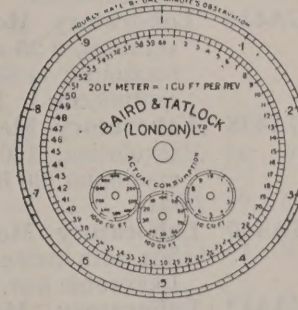
GA426



GA430



GA434



GA440

SIMMANCE-ABADY LABORATORY METERS.

These meters are for the accurate measurement of gas or air. In a variety of sizes and case materials, as follows :

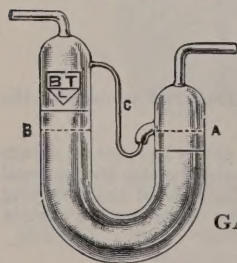
- In tinned steel, japanned inside and out and polished outside.
- In copper, ditto.
- In cast-iron, japanned suitable colour.
- In incorrodible porcelain; enamelled royal blue so as to be incorrodible by acid or foul gas, and can be used for the passage of absolutely clean air.

The case materials C and D are only used for the smaller meters, but the illustration (Fig. GA420-GA442) shows the general design of all sizes. Each meter has a foot with levelling screws, plumb bob, cast-brass water line sight box with removable lunette glasses (opal at back, clear glass in front); thermometer in brass case, accurately divided dial with polished brass bezel. Each meter has emptying plug, drain from spout, bell metal spindle and bearings carrying block tin drum; inlet and outlet unions. The capacities are plainly stated in the list on next page and illustrations of some of the dials are also shown above.

Capacity.	A. Tinned Steel.	B. Copper.	C. Cast-iron.	D. Porcelain.
GA420 Laboratory Meter, $\frac{1}{12}$ cubic foot per revolution, 18 cubic feet per hour maximum, showing hourly rate by one minute's observation	f£9 18 0	f£10 8 0	f£12 2 0	f£14 6 0
GA422 Laboratory Meter, as No. GA420, but with cumulative index. Fig. dial GA422	f£12 13 0	f£13 3 0	f£17 1 0	f£19 12 6
GA424 Laboratory Meter, $\frac{1}{10}$ cubic foot per revolution, 20 cubic feet per hour maximum. Shows from $\frac{1}{10000}$ to 100 cubic feet; also hourly rate. Fig. dial GA424	f£14 6 0	f£14 16 0	f£17 12 0	f£20 16 0
GA426 Laboratory Meter, 2.5 litres per revolution, 550 litres per hour maximum. Shows from 10 cubic centimetres to 2.5 cubic metres; also hourly rate. Fig. dial GA426	f£14 6 0	f£14 16 0	f£17 12 0	f£20 16 0
GA428 Laboratory Meter, $\frac{1}{4}$ cubic foot per revolution, 40 cubic feet per hour maximum (5 lt. size). Shows hourly rate	f£14 6 0	f£14 16 0		
GA430 Laboratory Meter, as No. GA428, but with index showing from $\frac{1}{4000}$ to 250 cubic feet. Fig. dial GA430	f£20 18 0	f£21 13 0		
GA432 Laboratory Meter, $\frac{1}{2}$ cubic foot per revolution, 80 cubic feet per hour maximum (10 lt. size). Shows hourly rate	f£18 14 0	f£19 13 0		
GA434 Laboratory Meter, as No. GA432, but with index showing from $\frac{1}{2000}$ to 500 cubic feet. Fig. dial GA434	f£25 6 0	f£26 5 0		
GA436 Laboratory Meter, 15 litres per revolution, 2.25 cubic metres per hour maximum. Shows from 60 cubic centimetres to 15 cubic metres	f£25 6 0	f£26 5 0		
GA438 Laboratory Meter, 1 cubic foot per revolution, 150 cubic feet per hour maximum (20 lt. size). Shows hourly rate	f£23 2 0	f£24 2 0		
GA440 Laboratory Meter, as No. GA438, but with index showing from $\frac{1}{1000}$ to 1000 cubic feet. Fig. dial GA440	f£29 14 0	f£30 14 0		
GA442 Laboratory Meter, 25 litres per revolution, 5 cubic metres per hour maximum. Shows from 100 cubic centimetres to 25 cubic metres	f£29 14 0	f£30 14 0		

Please state
whether type
A, B, C, or D,
is required.

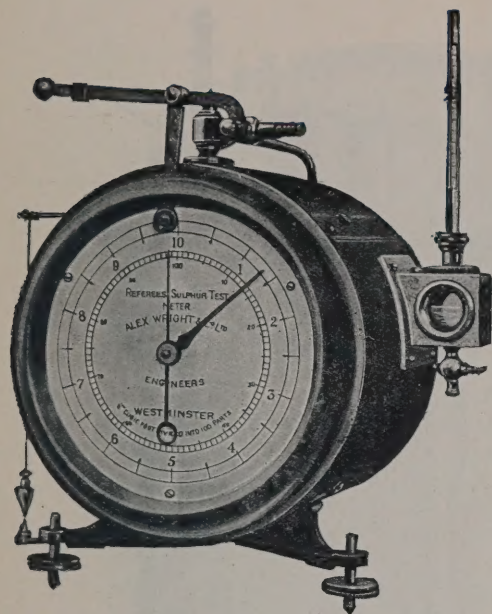
In ordering please specify catalogue number and case material required (A, B, C, or D).



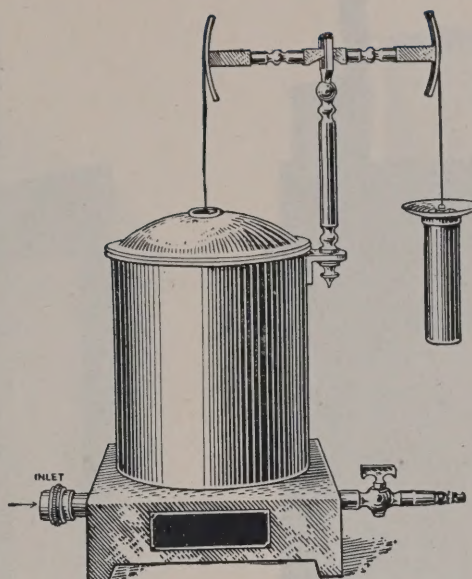
GA444

GA444 Beckett's Laboratory Gas Meter (see "Journal of the Society of Chemical Industry," Jan. 1917). This is a convenient laboratory apparatus for measuring the volumes of gases or their rates of flow. For chlorine and other gases only slightly soluble in water, water may be used, but if the gas is required dry, 80 per cent. sulphuric acid is recommended. For ammonia gas, paraffin oil may be used

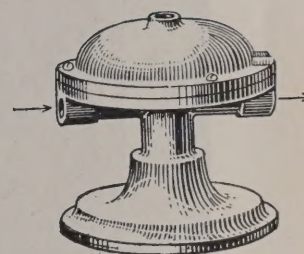
..... b £0 17 6



GA450-GA458



GA460



GA464

SPECIAL METERS.

We also supply two forms of special meters :

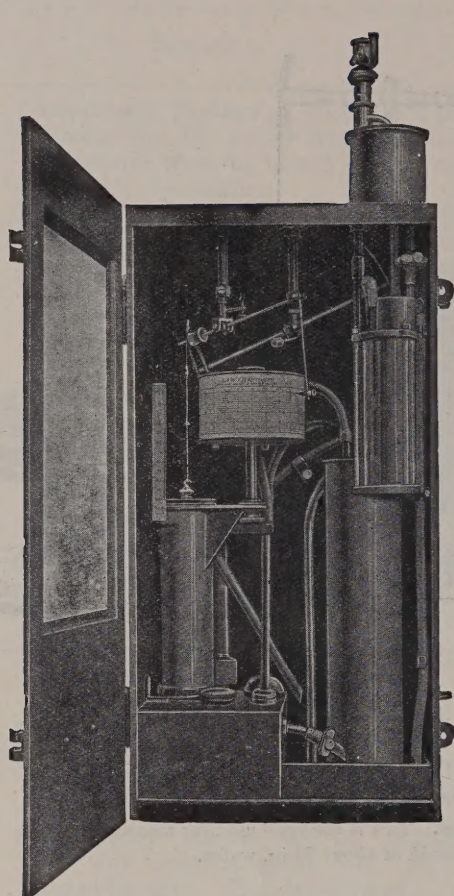
A. Arranged to automatically shut off gas after the passage of a predetermined amount. This is the type used for the Metropolitan Gas Referees' Sulphur and Ammonia Test, but can be applied to any purpose. GA450-GA456.

B. Arranged with special construction for the measurement of compressed gas. This is the type used for measuring gas in experiments with high-pressure burners, the gas being delivered at a maximum of about 80 in. water.

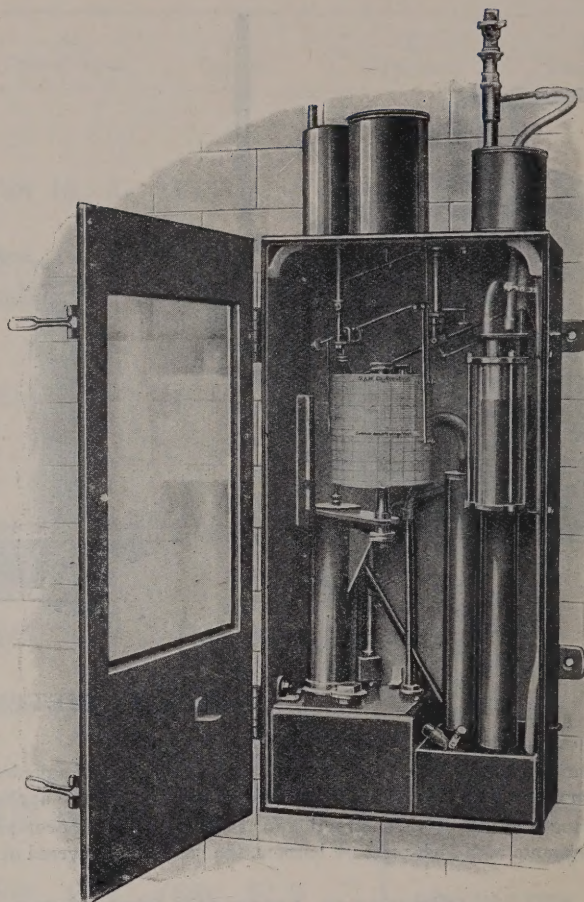
Simmance Automatic Stop Meter, Fig. GA450-GA458.

The stop movement is a very simple one, being exact and shutting off a tap on the outlet of the meter. It can be set to shut off from $\frac{1}{10}$ to 10 ft. of gas in tenths, while the stop movement can be also put out of action altogether. A second pointer to show the hourly rate by one minute observations enables the hourly rate to be adjusted.

GA450	Meter as above, in japanned steel case	....	....	....	....	....	f £20 16 0
GA452	Meter as above, in copper case	....	....	....	....	....	f £21 19 0
GA454	Meter as above, in cast-iron case	....	....	....	....	....	f £23 2 0
GA456	Meter as above, in porcelain case	....	....	....	....	....	f £27 10 0
GA458	Double-cased Pressure Meter, which can be utilised for various tests in a laboratory, at either ordinary gas pressure (if this is sufficient) or with the pressure increased by a water pump, showing from $\frac{1}{1000}$ to 100 cubic feet	....	....	....	....	....	f £16 3 6
GA460	Balance Governor, simple form, with beam balanced on knife edge, with counter-balanced shot tube, inlet union, and outlet tap and connection. A very sensitive, reliable and cheap instrument	....	....	....	....	....	f £5 10 0
GA462	Double-dry Governor, consisting of two diaphragm governors, the leather being specially selected and prepared. With brass pressure weights and cup for fine adjustment. In japanned box with inlet and outlet connections	....	....	....	....	....	f £1 10 0
GA464	Service Governor, consisting of suspended valve with leather diaphragm and spring adjustment. In cast-iron with cover, three-light size	without base	f 35/-	;	on base	f £2 2 0	



GA466



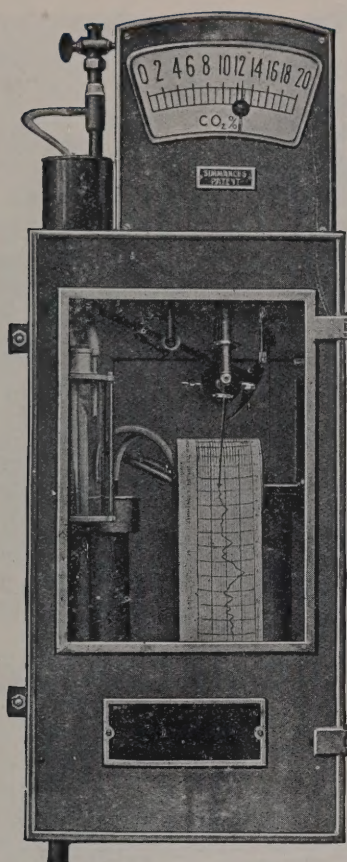
GA470

RECORDERS.

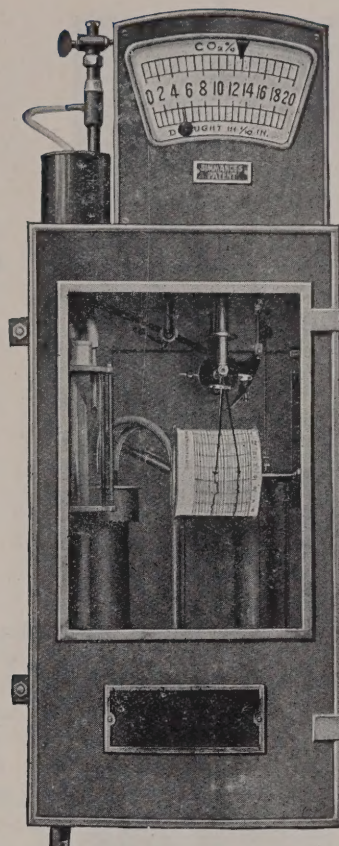
- GA466** The S.A.W. Patent Carbon Dioxide Recorder. With 24-hour chart as illustrated, or with 24-hour disc chart. (Please state which is required.) Complete with 50 charts and ink f £44 11 0
- GA468** Recorder as above, with 60-day tape chart. Complete with one chart roll and ink f £47 11 6
- GA470** Recorder as No. GA466, but made in combination with a draught recorder, a double chart being used upon which is recorded both the percentage of CO₂ and the draught. Complete with 50 charts and ink f £47 11 6
- GA472** Recorder as above, with 60-day tape chart. Complete with one chart roll and ink f £57 10 0

These are practical instruments, and many hundreds are in use all over the world.

They undoubtedly save on fuel costs.



GA474



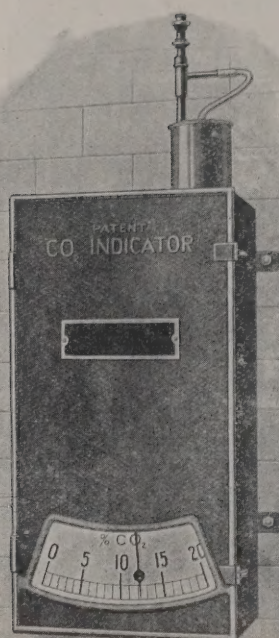
GA476

GA474 The S.A.W. Patent CO₂ Indicator and Recorder. A CO₂ recorder is now such an indispensable part of a steam plant that it is unnecessary to repeat the advantages and economy which follow its use. This is the latest and simplest form of instrument, and will not only continuously record, but continuously **indicate** (on a large open scale) the percentage of CO₂ in the flue gases. All fluid levels are self-adjusting, and the smallness of the amount of attention required renders this instrument the most practical ever placed on the market. The indications are shown on a large open scale so that the percentage of CO₂ can be read at a glance some distance from the instrument *f*£52 10 0

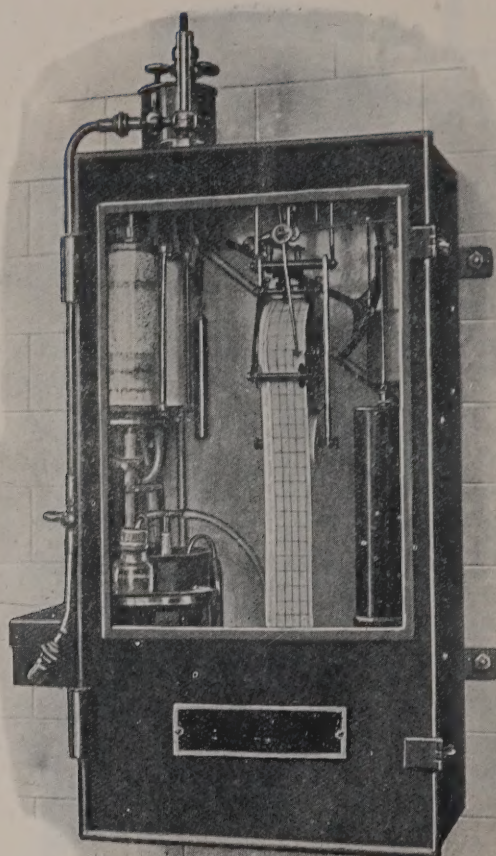
GA476 S.A.W. Patent CO₂ and Draught Indicator and Recorder. Careful control of the air supply is essential if best results are to be obtained from the available boiler-plant and the fuel, because incorrect draught conditions lead to poor combustion.

In order to stress the close relationship between both draught and CO₂ this instrument, in addition to continuously recording these variations, also indicates them on a large open scale.

The pointers are coloured red and black to distinguish them, and the records are made in red and black inks *f*£60 0 0



GA478

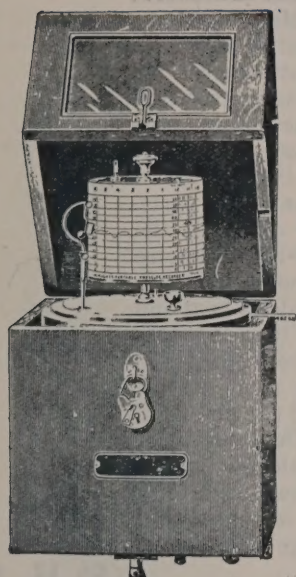


GA480

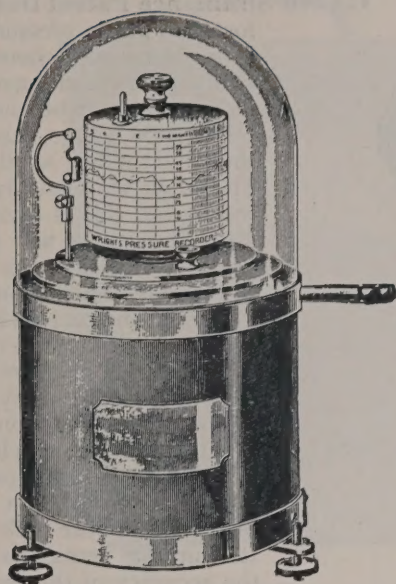
GA478 The S.A.W. Patent CO₂ Indicator. This CO₂ indicator is designed on the same general principles as those embodied in the S.A.W. Patent CO₂ Recorder, *i.e.* automatic adjustment of water levels, absorption of CO₂ by caustic potash solution, and remeasurement of the original sample. The indications are presented by a bold pointer moving over a very open and legible scale; they are continuous, and provide the stoker with the information necessary to the intelligent performance of his duties f £42 10 0

GA480 Selective Recorders for various industrial purposes, to record the percentage of CO, SO₂, etc., similar to illustration. Complete with charts and ink from f £50 0 0

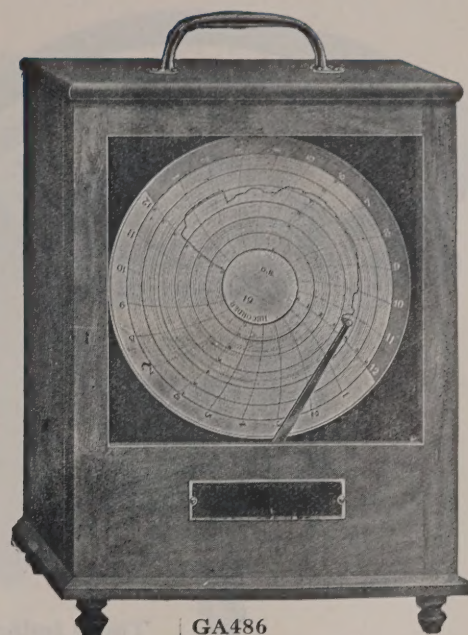
(The illustration shows the Carbon Monoxide Recorder, which is designed to give automatically and continuously a record of the percentage volume of the Carbon Monoxide content of a gaseous mixture, more particularly with reference to straight coal gas, water gas, producer gas, etc.)



GA482



GA484



GA486

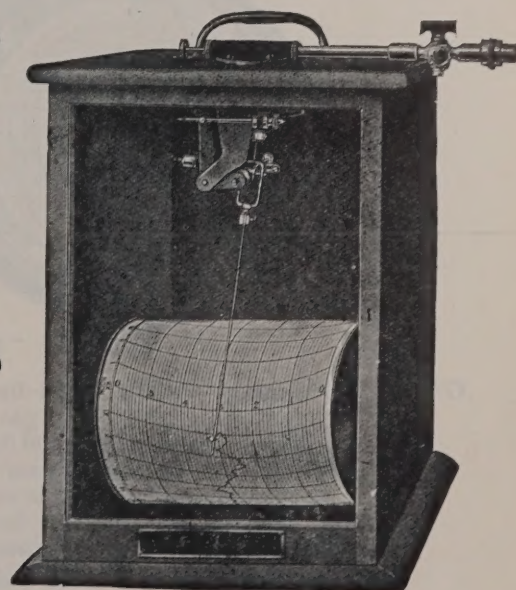
GA482 "Precision" Portable Pressure and Vacuum Recorder. Working with water seal, this instrument forms a "lock-up" register which may be attached by rubber tube to any air or gas service and left to record for a period of time with the certainty of finding a clear registration of any changes of plus or minus pressures which may occur. Any range up to 16-in. water. The prices of this type of register vary with the range. Price for 6-in. range, complete with 100 charts and ink f£13 15 0

GA484 "Precision" Pressure and Vacuum Recorder. Made on the U-gauge principle, the base and crown of the chambers in cast-brass, the clock (8-day) of the best make, and the drum carrying chart for 24 hours. The pen is actuated directly by the float, which is perfectly guided and sensitive. Levelling feet are provided, and the whole forms a very useful and reliable recorder of pressure changes. Usual range 6-in. pressure or vacuum, but made for any range up to 16-in. water.

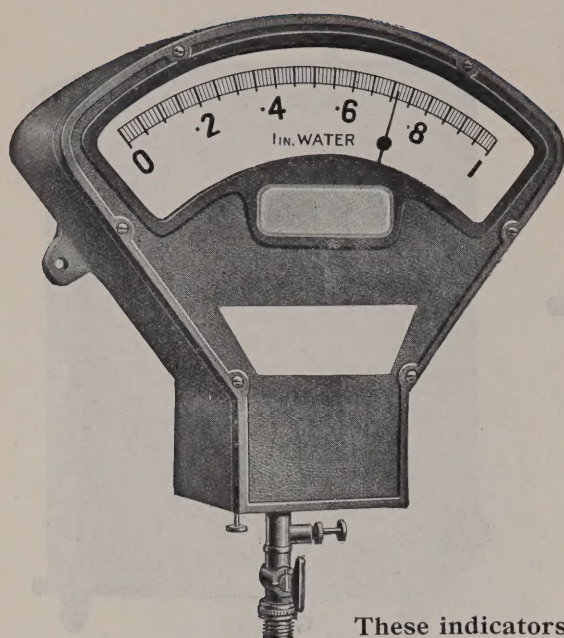
Price for 6-in. range, complete with 100 charts and ink f£12 2 0

GA486 Simmance Patent Portable Dead-beat Pressure and Vacuum Recorder, for ascertaining and recording pressure of gas, steam, air, or water in any situation. Made for any pressure or vacuum from a millimetre to 400 lbs.; 24-hour charts or for 7 days. Perfectly running clockwork, adjustment for pen; the whole scientifically accurate and well constructed. In polished wood case with handle for carrying, and suitable for connection to pressure source by rubber tube, or by union to metallic pipe. Uses no liquid. Weight, complete, about 8 lbs.; size 14 x 9 x 6 in. Complete with 100 charts and ink f£13 0 0

GA488 Simmance Patent "Large Scale" Drum Recorder. For any usual range of gas or air pressure or vacuum recorded on a **very open scale**—for instance, 6-in. pressure scale gives a full inch for 1-in. pressure. This is a most convenient form of portable recorder, and is only slightly heavier than the well-known light-weight recorder. Chart and drum revolving once in 24 hours, giving $\frac{3}{4}$ -in. space for each hour. In well-seasoned polished hardwood case. Complete with 50 charts and ink f£15 8 0



GA488

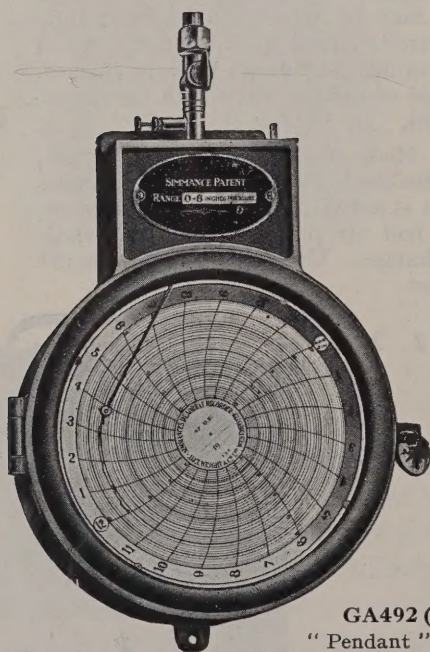
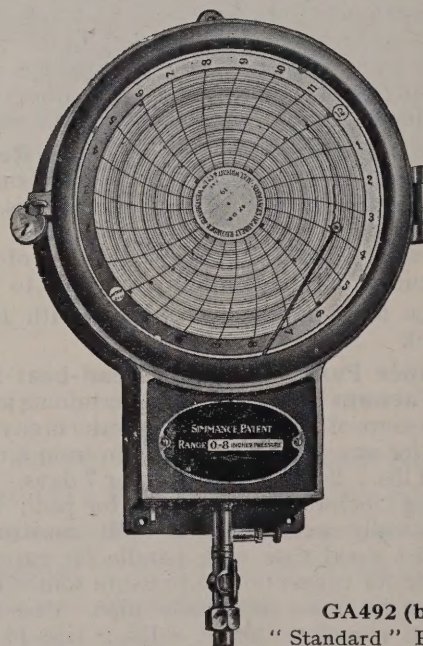


GA490

GA490 Simmance Patent Dead-beat Indicator, for vacuum or pressure. Modern engineering demands a more sensitive and more finely divided scale upon instruments for indicating draught and pressure than the water-tube gauge, and the gauge now shown is the last word in such apparatus. The whole scale and range is one inch of water, and this is divided into 100 parts. Thus the gauge will show down to the 1/100th inch of water (= 0.25 millimetre water gauge and 0.02 millimetre mercury). These fine indications being dead-beat and produced without the use of liquids enable variations of pressure to be determined with perfect accuracy and at a glance. The case is of cast-iron, and the details of manufacture ensure a long life. A damper is fitted to prevent oscillations; an external screw enables a constant zero to be obtained, and the cock is so arranged that its turning vents the gauge and proves the accuracy of the zero

.... f £6 12 0

These indicators can be supplied in any range to a maximum of 0-400 lbs. per sq. inch at same price.

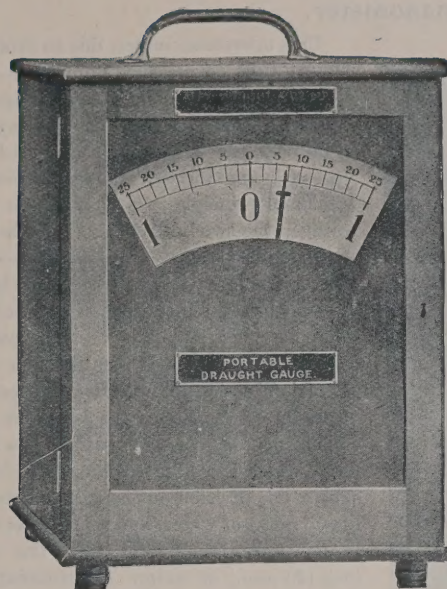
GA492 (a)
"Pendant" Pattern.GA492 (b)
"Standard" Pattern.

GA492 Simmance Patent Dead-beat Recorder, for vacuum or pressure. This instrument records on a chart any gas, air, steam or water pressure from half millimetre (25 millimetre range) up to 400 lbs. per square inch. Charts for 24 hours or 7 days. Suitable for gas, air, water or steam, and may be used on crude gas. Specially robust clock-work, and each recorder is in cast-iron case and provided with two-way cock for venting or shutting off; milled head adjustment for pen. Damping screw for stopping oscillations. Also for vacuum up to 15 lbs.

.... f £10 17 6

All standard ranges, high or low, at the same price.

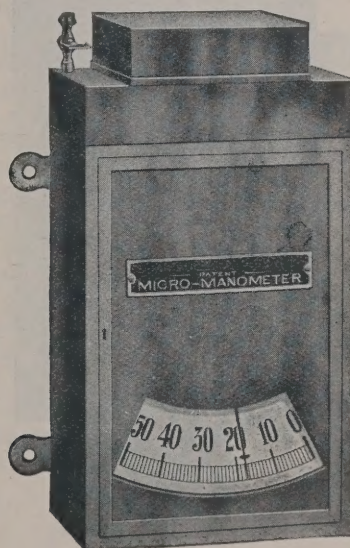
In ordering please state whether Pendant (a) or Standard Pattern (b) is required (see illustrations above).



GA494

GA494 Simmance Patent Portable Draught Tester (Dead-beat). Constructed for portable use and the obtaining of accurate and instant tests of draught and pressure in various parts of a boiler setting, retort bed, kiln flues, etc. No liquid is used and the attachment can be made with the greatest facility, whilst the pointer shows smaller changes of draught or pressure than are perceptible with any other form of indicator excepting

GA496 f £7 14 0



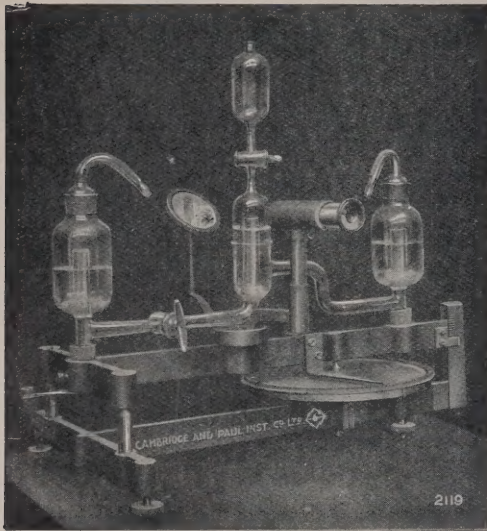
GA496

GA496 Simmance Patent Micromanometer. For use when the maximum pressure or vacuum is small and required to be shown in a magnified scale. The divisions shown on scale in illustration are **one-hundredths of an inch**, the total range being half an inch (of water). Thus quarter millimetres can be indicated, and, within certain limits, smaller or greater readings of pressure or vacuum. The four-bar mechanism used renders the action of this gauge certain and dead-beat, and the scale is very distinct and readable at a distance. In specially seasoned hardwood case

..... f £14 6 0

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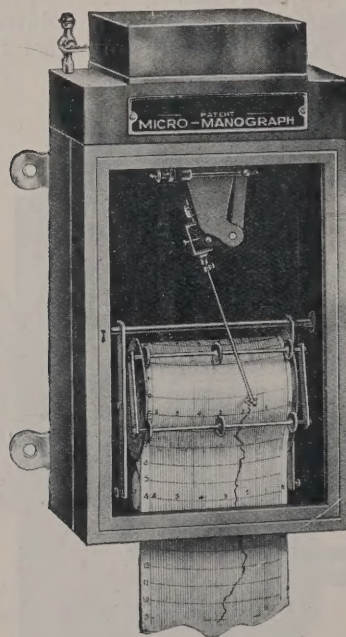
GA498 Chattock Tilting Micromanometer.



GA498

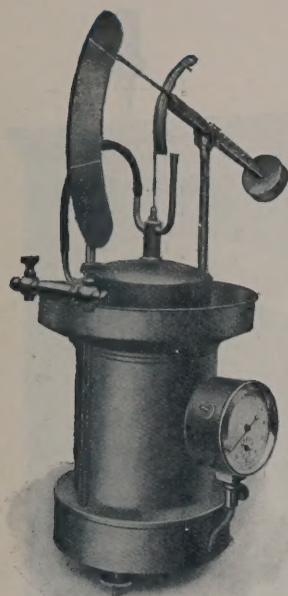
This micromanometer, due to Professor A. D. Chattock, is designed for use with a pitot tube to measure differences of pressure with a greater accuracy than is possible with a differential dial gauge, and to determine very small differences of pressure. The micromanometer may be used, for example, to measure pressures in burners, the flue draughts exerted by gas appliances, ventilator suction and pressures, and for the standardisation of other types of sensitive gauges. It is similar in principle to a U-tube, the difference of pressure on the surfaces of the water in the two limbs of the tube being measured by tilting the gauge through a small angle, so that there is no displacement of the water along the tube. Errors due to capillarity and viscosity are thus avoided. The glass U-tube, which is of unusual form, is mounted on a metal frame, the tilt of which can be varied by a micrometer screw. The central vessel contains oil and water, the surface of separation of which is seen through a microscope attached to the frame. Any alteration in the difference of pressure in the two vessels forming the extremities of the U-tube causes a displacement of the separation surface, which is kept in coincidence with the cross-wire of the microscope by rotating the micrometer screw head, which is calibrated directly in inches head of water pressure. In the model shown one division on the head corresponds to a pressure difference of 0.0002 inch (0.005 mm.) of water, and a movement of less than one-quarter of a division can be detected by the microscope. The maximum pressure measurable is about 0.8 inch (20 mm.) of water. Instruments fitted with U-tubes of somewhat different design can be supplied for other applications.

Price f £29 0 0



GA500

GA500 Simmance Patent Micromanograph. An automatic recorder of very small conditions of pressure or vacuum. One-hundredth of an inch of pressure or vacuum, or $\frac{1}{4}$ millimetre (of water) can be registered. The total range, of course, must be small, say half-inch of water, as the width of chart is the limit, but this is magnified 8 times and subdivided. Chart runs off 13 inches per 24 hours, and one roll of chart lasts for 60 days, being torn off daily as desired. Complete with two 60-day chart rolls and one bottle of ink f £24 4 0



SPECIFIC GRAVITY.

GA510 Simmance Specific Gravity Bell, for ascertaining the gravity of gases by the effusion method. Adopted by the Government. With stop clock f **£14 6 0**

GA512 Specific Gravity Bell as above, but without stop clock f **£12 7 6**

A well-made case for carrying the Specific Gravity Bell can be supplied, making the whole readily portable.

GA510-GA512

GA514 Apparatus for Determining the Specific Gravity of Gases in Small Quantities, as described by Alfred Blackie, M.A., in Fuel Research Board Technical Paper No. 5. Complete apparatus, consisting of: copper water jacket 24 feet in length, 1½ in. internal diameter, fitted with three adjustable clamps for fixing to wall, four copper tubes ½ in. internal diameter passing right through the water jacket and suitably stayed to sides. Two of these tubes are bent over at top and fitted with drums with perforated bottom to allow the escape of gas or air. A third tube is fitted with a doubled length of insulated wire, the ends being brought out at the bottom to double terminals mounted on an ebonite block. The water jacket is fitted at the bottom with a copper pipe for water supply, and with a copper overflow pipe at top, leading to waste. A stand is provided for holding the scale and pressure pipe. Price, including glass parts f **£15 17 6**

Above price does not include the Chattock Micromanometer. (See GA498.)

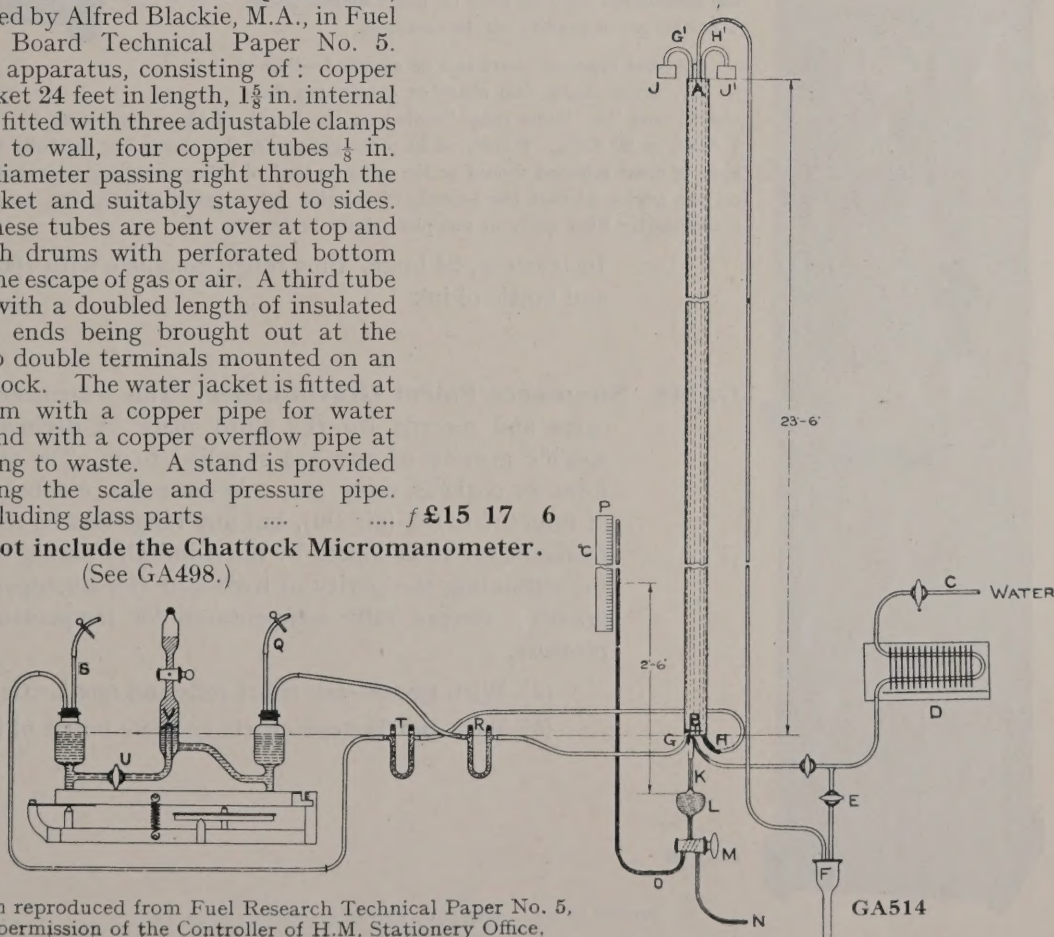


Illustration reproduced from Fuel Research Technical Paper No. 5, by kind permission of the Controller of H.M. Stationery Office.

GA514

GA516 Simmance Patent Gravitometer (Recording and Indicating).

This instrument forms a most sensitive "tell-tale" of changes in the constitution of gas during process of manufacture. With its help the engineer can form an instant opinion as to the cause, or causes, of the slightest variation in the calorific value. A variation in the quality of the gas is indicated by variation in specific gravity, and as the scale of the indicating dial and chart divisions show to the second place of decimals much finer indication is afforded than by any type of recording calorimeter.

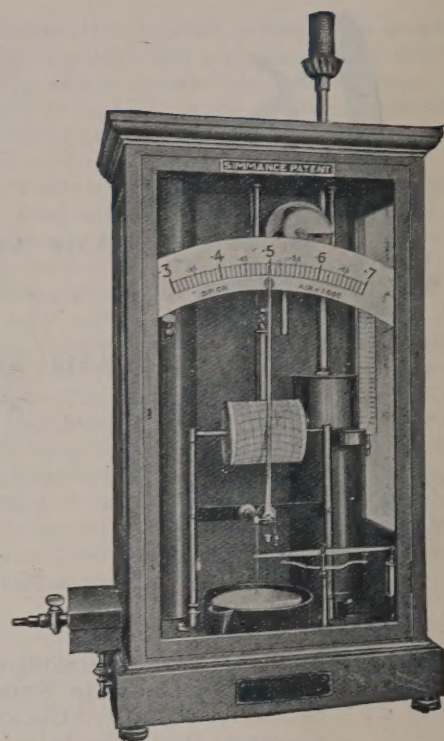
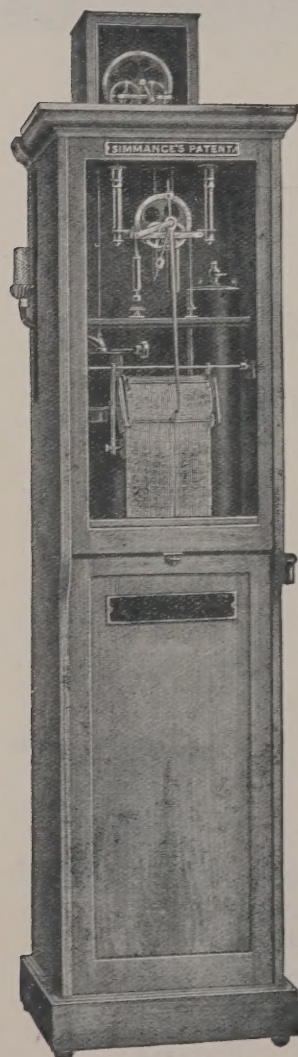
Until the production of the gravitometer no scientific method has been introduced to be of immediate service in giving information as to the causes of changes in calorific value. An engineer would observe that the quality of the gas had increased or decreased, and, unless the change was comparatively startling, had to leave it at that. With the assistance, however, of this apparatus, light is thrown upon the working of the process of manufacture, and irregularities in the working can be detected and dealt with with the greatest certainty.

As will be seen, the scale gives the specific gravity at a glance, whilst at the same time an accurate record is made; and, obviously, the instrument can be supplied with both indicating scale and recording chart, as shown in illustration, or scale only or chart only.

The gas capacity of the instrument is very small, so that changes are betrayed almost instantly, and the advantage of this will be at once seen. The scale is from .3 sp. gr. to .7 sp. gr., which covers all working ranges of modern gas making; but if the instrument is to be used on experimental gases, other ranges of gravity can be arranged.

Several types of chart can be supplied—that is to say, drum chart, disc chart or continuous tape chart; and the "time range"—that is, the length of chart run—may be 24 hours, 7 days, or 60 days. Where, as in most gasworks, the charts are carefully filed, the type of chart selected should be the same as that of other recording instruments used on the works, so that the records of calorific value, pressure, CO₂, CO, etc. may be conveniently filed away in complete daily or weekly sets.

Instrument, 24 hours' time range, complete with 100 charts and bottle of ink f £66 0 0

**GA516****GA518**

GA518 Simmance Patent Gravitometer. This instrument indicates and records (to the third place of decimals) the specific gravity of any gas supplied to it. The standard form for coal gas, water gas, coke-oven gas, etc. has a range of from 0.7 to 0.3 (air 1.0), but any range can be recorded. Designed for and adopted by the Admiralty during the War for estimating the purity of hydrogen (for airships) by its gravity. Record fully compensated for temperature and pressure.

- (a) With two 60-day chart rolls and one bottle of ink f £71 10 0
 (b) With 100 24-hour charts and one bottle of ink f £66 0 0

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